DOCUMENT RESUME

ED 378 056 SE 055 682

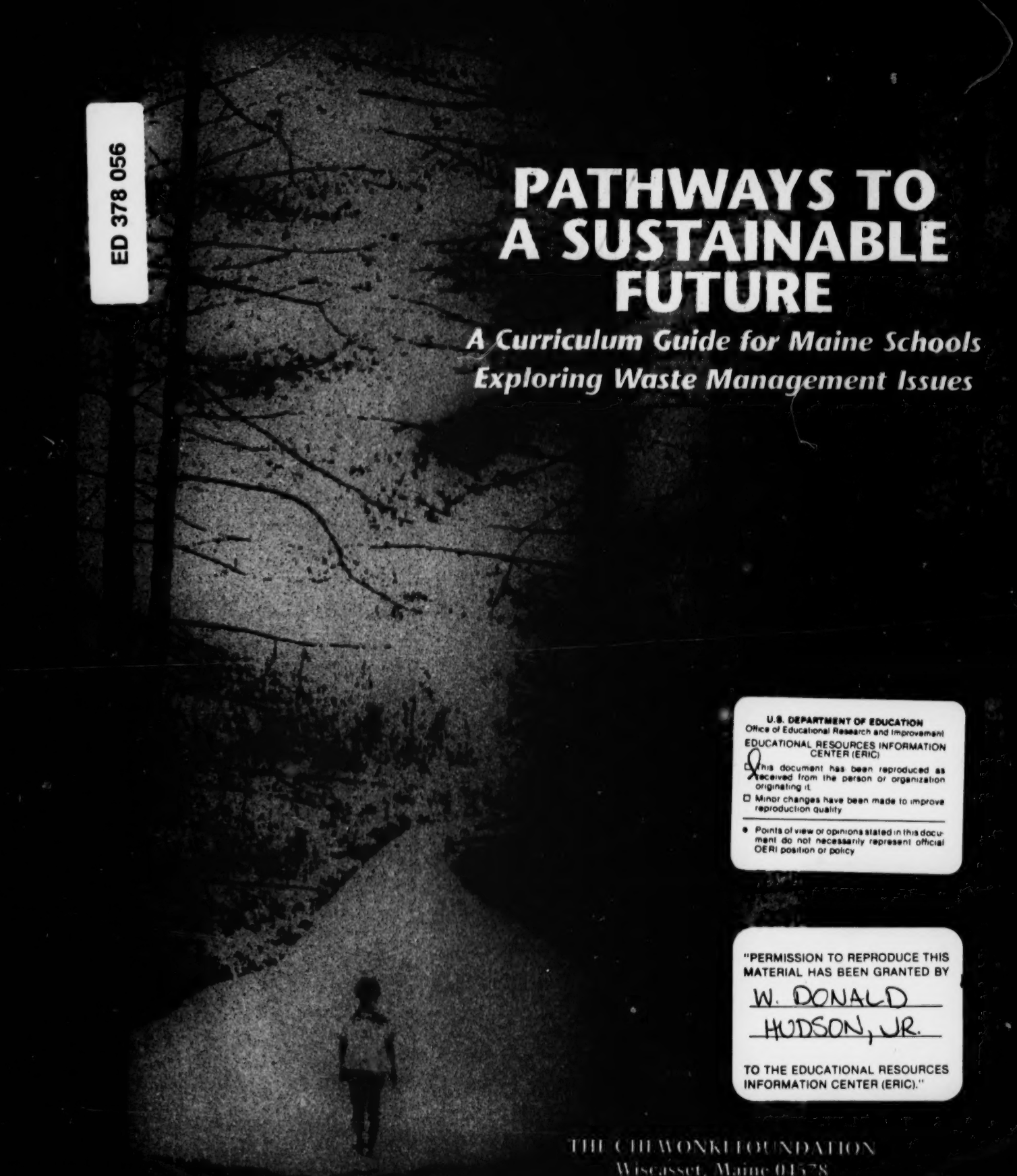
TITLE	Pathways to a Sustainable Future: A Curriculum Guide for Maine Schools Exploring Waste Management Issues.
INSTITUTION	Chewonki Foundation, Wiscasset, ME.
SPONS AGENCY	Maine Waste Management Association, Augusta.
PUB DATE	94
NOTE	243p.
AVAILABLE FROM	Maine Waste Management Agency, State House Station 154, Augusta, ME 04333.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC10 Plus Postage.
DESCRIPTORS	Curriculum Guides; Educational Resources; Elementary Secondary Education; *Environmental Education; Instructional Materials; Interdisciplinary Approach; *Problem Solving; Recycling; Solid Wastes; *Student Projects; Teaching Guides; *Waste Disposal
IDENTIFIERS	Environmental Action; *Maine

ABSTRACT

This action guide is designed to help students and teachers become aware of the concepts and issues of waste management, and to motivate them to action in the classroom, school, home, and community. The guide emphasizes interdisciplinary activities that concentrate on the process of problem solving. Activities are identified by appropriate grade level grouped for beginning (K-4), intermediate (3-8), and advanced (6-12) students. Key sections in the guide contain: (1) an introductory story "The Birds of Zazurds"; (2) six awareness activities that help students identify the waste management problem; (3) six awareness activities that help students explore various actions; (4) seven self-evaluation/inventories that help students characterize the waste in school or home and then prioritize the waste problems; (5) 25 simple and advanced "Pathways to Action" projects, and samples of projects completed in Maine schools; and (6) background information, and resources (38 instructional resources, 11 trade books for younger children, 51 organizations and agencies, 28 teaching guide summaries from the California "Compendium for Integrated Waste Management," and a 100-word glossary). Development of the guide was directed by Maine's Common Core of Learning, and the "Critical Skills Classroom" model based on experiential education. (LZ)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 378 056



PATHWAYS TO A SUSTAINABLE FUTURE

A Curriculum Guide for Maine Schools Exploring Waste Management Issues

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

W. DONALD HUDSON, JR.

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

THE CHEWONKI FOUNDATION
Wiscasset, Maine 04578

MAINE WASTE MANAGEMENT AGENCY
Office of Waste Reduction and Recycling
Augusta, ME 04333

BEST COPY AVAILABLE

PATHWAYS TO A SUSTAINABLE FUTURE

A Curriculum Guide for Maine Schools Exploring Waste Management Issues

DEVELOPED BY
the Chewonki Foundation
for the Maine Waste Management Agency

PRINCIPAL AUTHORS
Michael Heath and Andy Barker

ILLUSTRATIONS BY
Josephine W. Ewing

The Chewonki Foundation
Wiscasset, Maine 04578

Maine Waste Management Agency
Office of Waste Reduction and Recycling
Augusta, ME 04333

printed on recycled paper

Curriculum Advisory Committee

Gayle Briggs
Maine Waste Management Agency

Peter Corcoran
Department of Education, Bates College

Tom Keller
Maine Department of Education

George MacDonald
T&R Associates, Bath

Core Group of Teachers

David Galin
Coffin School, Brunswick

Sue Kistenmacher
Wiscasset Middle School

Donna Maxim
Center for Teaching and Learning, Edgecomb

Bob Olney
Waynflete School, Portland

Mona Schlein
Wiscasset Primary School

Supporting Teachers

Linda Baum
Gilford Butler School, Thomaston

Mary Dunn
Mt. Merici School, Winslow

Ernie Kozun
Windham Jr. High School

Don McDougal
Nokomis Regional High School, Newport

Kandy Meyers
Bristol Consolidated School

Margaret Pennock
Soule Program, Mast Landing School, Freeport

Cheryl Pike
W.G. Mallett School, Farmington

Elizabeth Postlewaite
SeDoMoCha Middle School, Dover-Foxcroft

Pat Snow
Gilford Butler School, Thomaston

Fran Spiotta
Grammar School, Livermore Falls

Naomi Vaughan
Martel School, Lewiston

Sylvia Yeaton
W.G. Mallett School, Farmington

Pathways to a Sustainable Future was developed by the Chewonki Foundation under contract to the State of Maine, Maine Waste Management Agency for use in Maine schools.

The Chewonki Foundation is a non-profit educational institution established in 1963 as an outgrowth of Camp Chewonki, which was founded in 1915. Chewonki began year-round programming in 1970 and currently offers Camp Chewonki (for boys 8-15) and Wilderness Expeditions (for boys and girls 13-18), Environmental Education and Outreach Programs for school groups, and the Maine Coast Semester (for 11th graders), and Workshops and Wilderness Expeditions (for family groups and individuals). The Resource Center at Chewonki works closely with a number of state and federal agencies, school districts, and individual schools to develop new programs and educational materials. All projects and associated teacher training programs stress aspects of group process and interdisciplinary learning. *All Chewonki Foundation programs are drawn clearly and cleanly from its educational mission: To foster personal growth through group interaction in the context of the natural world.*

The Maine Waste Management Agency was established by the Maine legislature and is responsible for administering the state's waste management and recycling programs. The Agency includes the Offices of Planning, Siting and Disposal Operations, and Waste Reduction and Recycling. Among many other areas, the Office of Waste Reduction and Recycling is responsible for developing a public education program for solid waste management and recycling.

The Chewonki Foundation
RR 2 Box 1200
Wiscasset, ME 04578
(207) 882-7323.

Maine Waste Management Agency
State House Station 154
Augusta, ME 04333
(207) 287-5300 or (800) 662-4545.

Copyright © 1994 The Chewonki Foundation, all rights reserved. Permission is granted for teachers to duplicate activity pages for classroom use only.

Table of Contents

Acknowledgements

Introduction 8

The Birds of Zazurds: A Story About Waste and Action 14

The Birds of Zazurds ● ■ ◆
written by Andy Barker, illustrated by Josephine Ewing 15

Discussion Questions 32

Follow-up Activities

Our School the Gulligutt Tree ● 33
Birds of Zazurds Play ■ 34
Zazurds II ◆ 35

Waste Awareness Activities Part 1: What is the Problem 37

Drop in the Bucket ● ■ ◆ 38
What difference does my trash make

How Much Trash? ● ■ ◆ 40
How much waste am I responsible for?

Mounting Milk Cartons ● 42
How fast does milk carton trash accumulate in our school?

If Toys Could Talk ● 44
How have toys changed from the days when our grandparents were young? How was our grandparents' waste different?

Bread and Kisses ■ ◆ 46
How does consumption and life style relate to waste generation?

Getting to the Route of the Hazardous Waste Problem ■ ◆ 48
What's wrong with throwing used oil down the drain?

Waste Awareness Activities Part 2: Can I Make a Difference? 51

Everyday Choices for a Sustainable Future ● ■ ◆ 52
How do you know which are the best products to buy when you go shopping?

For Better or Worse ● ■ ◆ 58
How can I make good decisions about packaging I buy in the store?

Are Ten Better Than One? ● ■ 60
How does the size of a package affect how much packaging is used and how much waste is produced?

Paper, Plastic, or Cloth? ■ 62
When we go shopping, what kind of bag is best?

Where'd You Get That Can? ■ 71
Why is recycling aluminum more efficient than making aluminum cans from raw materials?

Test the Alternatives ● ■ 74
How can we reduce the use of hazardous cleaning products at school and at home?

Self Evaluation: Inventories of waste production at school and at home 79

School Waste Audit ● ■ ◆ 80
How much trash do we produce in our school?

School Hazardous Waste Audit ■ ◆ 84
What hazardous wastes do we produce in our school? What should be done with them?

Source Reduction/Recycling Quiz – Consumer Surveys for Students and Adults ● ■ ◆ 87
How can we be part of the solution?

Home Waste Audit ● ■ ◆ 92
How much trash does my family generate?

Home Household Hazardous Waste Audit ■ ◆ 94
What household hazardous materials do I have in my home? What should I do with them?

Local Waste Management Options ● ■ ◆ 97
If there is no such place as "away," where does our trash end up?

Trash Sorting Relay Race ● ■ 100
How should trash be separated in our community?

● = *Introductory levels (approx. K-4)*

■ = *Intermediate levels (approx. 3-8)*

◆ = *Advanced levels (approx. 6-12)*

● = *Introductory levels (approx. K-4)*

■ = *Intermediate levels (approx. 3-8)*

◆ = *Advanced levels (approx. 6-12)*

Pathways to Action – Action projects to make a difference 102

Simple Classroom Action Projects 105

Source Reduction Projects 107
Classroom Source Reduction Campaign ● ■ ◆ 108
Cafeteria Source Reduction Campaign ● ■ ◆ 109
School Source Reduction Publicity Campaign ● ■ ◆ 111
"Junk" Mail Reduction Effort ● ■ ◆ 112

Reuse Projects 117
Classroom and Office Paper Reuse Campaign ● ■ ◆ 118
Used Clothing Drive and Swap ● ■ ◆ 119
Magazine Reuse Campaign ● ■ ◆ 120
Trash-to-Art Festival ● ■ 121

Recycling Projects 123
School Recycling Program ● ■ ◆ 124
"Buy Recycled" Campaign ■ ◆ 126
Home Recyclables Collection Center ■ ◆ 130

Composting Projects 133
Classroom Worm Bin Project ● ■ 134
Cafeteria Composting Project ● ■ ◆ 137
Plans for Constructing Compost Bins 140

Incineration and Landfilling Projects 145
Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy ■ ◆ 146
Landfill Siting Investigation ◆ 148

Household Hazardous Waste Reduction Projects 153
Promoting Alternatives to Hazardous Products ■ ◆ 154
Waste Paint Exchange Project ■ ◆ 155
Battery Use Reduction and Rechargeable Battery Promotion ■ ◆ 157

Tools for Action:
Resources and strategies that help in all action projects 159
Letter Writing for Results 160
Publicity 162
Public Service Announcements 164
Pushing for a Change 168

Featured Teacher and Other Programs:
Creative Programs in Maine Jr. High and High School classrooms and additional valuable programs available to Maine schools 171
Gail Adshead – Garbology Unit Cape Elizabeth High School 172
J. B. Kavaliauskas – The Raging Recycling Riots, South Portland High School 176
Ernest Kozun, Jr. – Jr. High Recycling Program, Windham Middle School 179
Mary K. Wells – Household Hazardous Waste, Warsaw Middle School (Pittsfield) 182
Sue West & Dave Leibmann – Solid Waste Student Service Projects Maine Coast Semester Program (Wiscasset) 185
David Wilkins – Student-run Summer Camp Katahdin High School (Sherman Station) 188
Other Programs 192

Background Information and Resources 197

Background Information
Overview 198
Source Reduction 202
Reuse 205
Recycling 207
Composting 213
Waste-to-Energy, Incineration 217
Landfilling 221
Household Hazardous Waste 224

Resources
Instructional Resources 229
Trade Books for Younger Students 233
Organizations and Agencies 234
California Compendium for Integrated Waste Management: Reviews of outstanding curriculum materials summarized from the Compendium 239
Glossary 245

Preface

A fundamental principle of ecology states that "all things are connected." The paper you are looking at now has made an epic journey from its former life as a tree, through a paper mill, and through the printing process to your hands. Because it is recycled paper, some of the fibers have been through the mill two or three times. This same piece of paper may have a long road ahead, too. Its future depends on the choices *you* make. Your choice to throw it away or to recycle it will affect the future of other trees, the use of energy in manufacturing and transportation, and the quality of air and water. Your quality of life will even be affected by the decisions you make regarding waste.

Waste *management* involves much more than recycling. Managing waste means adjusting lifestyles and choices we make every day, from deciding what to buy and how to use products, to discarding those items and their packaging. Additionally, taking action to improve the waste situation can mean making demands on retailers to provide "greener" choices, thereby influencing manufacturers to produce environmentally sensitive products with less consumptive processes. Indeed, all things are connected; it is also true that "what comes in the front door goes out the back door." We can protect the quality of our backyard by watching what we bring in our front door!

Our modern American society has gotten away from the conservative New England tradition which advised "use it up, wear it out, make do, or do without." Because of choices made over the course of generations, our students today are facing the prospects of depleted natural resources and a more polluted environment tomorrow. As citizens of Maine and the United States *we all* have created significant waste management problems. Solving those problems requires each of us to get involved.

Lifestyle changes which result in reduction, reuse, and recycling will certainly help the environment. They will also save money. Waste disposal is becoming more costly with time and the expense is covered by taxpayers. The fiscal savings of responsible waste management may be as important as the environmental advantages.

Pathways to a Sustainable Future is designed to help students and teachers become aware of the concepts and issues of waste management. This is not simply an activity guide. It is a guide to *action*. Students are encouraged to be the actual problem solvers. They are asked to decide on the problems to tackle; they learn to ask important questions; they develop the skills to answer the questions. Finally, they take action. Working through this process empowers them to effect change. Changing behavior at school and taking action at home will help students, their families, and their community look to a brighter future.

Introduction

The purpose of *Pathways to a Sustainable Future* is to raise the awareness of students and their teachers about waste management issues, to motivate them to action in their classrooms, schools, homes and communities, and to help them make a real difference in the future of the Earth. Today's students are generally more aware of the environment and the problems of "trash" than their teachers were in their own school days. In fact, each succeeding class seems to be more in-tune with the issues than the previous one. Yet, we must all see ourselves as part of the solution. As teachers and responsible global citizens, we can help students move beyond awareness to action.

What

Pathways challenges students and teachers to become active problem solvers and to take action on the real problems of their school, their homes, and their community. The program helps students expand their awareness of waste issues in their school and community, decide on which problems to tackle, and learn specific skills needed for success. This empowers students to effect real change. Throughout *Pathways to a Sustainable Future* , students are encouraged to look at their own habits and evaluate their own behavior, and to decide on changes that will help the school and their families to become more environmentally responsible. This process is facilitated by an engaging story, Awareness Activities, Self-evaluation Inventories, and the Pathways to Action. Background information and resources are also included.

The *Pathways* program is less an activity guide and more a blueprint for action projects that students can use to solve real problems. It is a guide to help teachers and students understand local waste management issues, decide on priorities, then take effective, responsible action.

Who

This guide was developed for teachers and students in grades K-12. Levels within the range are indicated for various activities and projects. The symbols used throughout the guide are:

● **Beginning**	**K-4 (approx.)**
■ **Intermediate**	**3-8 (approx.)**
◆ **Advanced**	**6-12 (approx.)**

There is a wide range within each level and a great deal of overlap between levels. The story "Birds of Zazurds" was developed primarily for students in grades K-6. The action projects in general lend themselves to elementary, middle, and Jr. High students. The Featured Teachers projects are aimed at Jr. High and High School levels. The developers of the materials feel that teachers are in the best position to choose which activities are most appropriate for their particular classes, and make adjustments according to the needs of the students. Many of the activities and resources, and much of the background information refer specifically to Maine. The materials, however, are not limited to Maine schools.

Why

Pathways to a Sustainable Future was conceived as the next critical step in waste education in Maine. Many activity guides are available to help teachers raise student awareness. *Waste Away*, developed by the Vermont Institute of Natural Science, is a more aware of waste problems, the need for recycling, and their responsibility for protecting the quality of the environment. The *Waste Away* program is evaluated in the *Compendium for Integrated Waste Management*. This evaluation is included in the Resources section of *Pathways*.

The emphasis of most waste education programs has been raising awareness while offering only a few "how to" suggestions for action steps. In contrast, *Pathways to a Sustainable Future* offers a few activities to help focus awareness and then develops a wide range of projects so students and teachers can take the most appropriate action steps.

This program was initiated by a legislative mandate adopted in 1989. The legislature called upon the Maine Waste Management Agency's Office of Waste Reduction in cooperation with the Department of Education to develop a curriculum for use in Maine Schools, kindergarten through grade 12 (MSRA Title 38 Section 2139, paragraph 2.)

How

Teachers are encouraged to follow any sequence of activities that will lead to the most effective action projects and learning by the students. Some teachers may integrate all events into the regular curriculum rather than adding to the time needed to "cover" the regular subject areas. Others will encourage special interest activity groups or after-school "clubs." The issues can be introduced in as little as one period and simple action steps can be started immediately. More involved attention to developing awareness and completing more complicated projects can engage students for the entire school year. Students are also encouraged to share their information and concerns with other students and grades in the school, and their famlies.

Each section of the *Pathways* program can stand on its own. Teachers can "hop on" the program at any point that is appropriate for their students. The flow chart indicates how the various sections relate to each other. The ultimate goal is to have students take action to help solve part of the waste problem at school, at home, or in the community. All activities lead to a Pathway to Action!

"The Birds of Zazurds" Most elementary classes begin the *Pathways* program by reading "The Birds of Zazurds" and relating the story to their own waste problems.

Awareness Activities If the class needs more information about the issues, they should do one or more of the Awareness Activities before going on to the Self Evaluation/Inventories.

Self Evaluation/Inventories It is helpful to have an objective measure of the waste produced before identifying action projects to address waste issues. The Self Evaluation/Inventories help students characterize the waste in school or home and then prioritize the waste problems.

Pathways to Action After setting priorities based on the inventory, the Pathways to Action project(s) can begin. Some classes may decide to engage in an action project immediately. Simple Classroom Action Projects can be initiated as soon as students recognize the need for action. Activities and inventories can be used as necessary to give students the background they need during the action project. The Featured Teachers section describes successful, innovative projects initiated by teachers at the Jr. High and High School levels. These are samples of projects that can inspire other teachers to develop and adapt programs for their schools.

Background Information and **Resources** are references for both teacher and student use. Since statistics and contact information can become obsolete even before a publication goes to press, the Maine Waste Management Agency can provide updated information. Also included are summaries of existing curricula reviewed in the California *Compendium for Integrated Waste Management*, and a glossary.

Process

Common Core of Learning The development of Pathways to a Sustainable Future was guided by Maine's Common Core of Learning. The Common Core is an integrated presentation of the knowledge, skills, and attitudes recommended for Maine education which has received national recognition and praise. The Common Core concepts are organized into the areas of Personal and Global Stewardship, Communication, Reasoning and Problem Solving, and The Human Record. These concept areas tie all disciplines together and are well supported in all of the *Pathways* activities. *Pathways to a Sustainable Future* helps schools meet the Common Core challenge to provide experiences which actively involve students and are personally meaningful, engage them in genuine communication and in solving real problems, encourage students to work together, and help members of the community to become actively involved in the educational process.

For more information contact
Maine Department of Education
Division of Curriculum
State House Station # 23
Augusta, ME 04333
(207) 287-5925

Critical Skills Program, Antioch New England Graduate School The Critical Skills Classroom™ is a comprehensive and dynamic model that arose from the belief that education must be experiential— that it must nurture interdependence and must enable all members of each generation to develop the judgment necessary to take responsibility for the conduct of their lives, for the shaping of their society and for the survival of the planet. Since 1982, the Critical Skills Program has been offering training for experienced educators in the Critical Skills Classroom™ model through its summer institutes. The centerpiece of the Critical Skills model has been the real-life problem in need of a solution. Through the "Learning by Real Problems" approach, students move outside the classroom, take action on issues, and have a tangible impact in their communities. The Critical Skills program is entirely compatible with the goals of *Pathways to a Sustainable Future*.

Training programs in the Critical Skills model are offered through summer institutes. Each summer, 10-15 Critical Skills Institutes take place in Maine. See the description of the Critical Skills Program in the "Other Programs" section of Pathways to Action in this guide.

Other Models Similar challenges for real-life problem solving and student action are posed by new, exciting models of general education and science education: American Association for the Advancement of Science (Project 2061), National Science Teachers Association (Scope, Sequence and Coordination), and the Coalition of Essential Schools. These programs recognize the importance of a student's investment in his or her own learning, and the role of real-life issues and projects.

Assessment

Pathways to a Sustainable Future emphasizes "process" in activity development. Students working in groups, deciding on problems to be addressed and designing action projects to solve those problems are key elements to the program. Most of the activities and projects are open-ended and interdisciplinary, and standardized grading or testing is difficult in many cases. It is also difficult to evaluate an individual's learning in the context of group work. Yet there are many specific skills addressed in each activity which can lead to important academic progress for each student. Many skills can be evaluated on an individual basis, for example, writing, research, organizing, public speaking, participation in discussions. The products of student work are concrete examples of learning and skill development and through them you can assess a student's responsiveness.

Pathways provides a good opportunity for teachers to look at alternative methods of assessing student learning. Consult with colleagues, administrators and the Department of Education to explore current developments in assessment.

Student Empowerment

Children today are aware of environmental issues and they are concerned about the problems facing the earth. They have developed this sensitivity from massive exposure to television and the media. Now, "eco-books" are emerging to reach them at home and school. Students are eager for information that will help them understand today's problems, and they feel the need to make a difference. At the same time, today's children are scared. They worry about the ozone, endangered species, rain forests, pollution, and garbage. These threats to the earth have put a lot of pressure on young people to deal with the problems. Yet they have not created the problems, they are only likely to inherit them.

Stephen R.C. Hicks, a philosophy professor at Trenton (NJ) State College, argues that adults (including teachers) place a heavy burden on children before they have the tools to cope with the weight of the world. Just as you can't teach calculus before arithmetic, children "can't deal with problems of international garbage disposal when they are still grappling with issues of personal hygiene." Many waste-related issues are complex, and even adults have difficulty dealing with most of them. Hicks reminds us, "We need to take extra pains to teach our children about the principles involved on a scale they can grasp."

Introduction

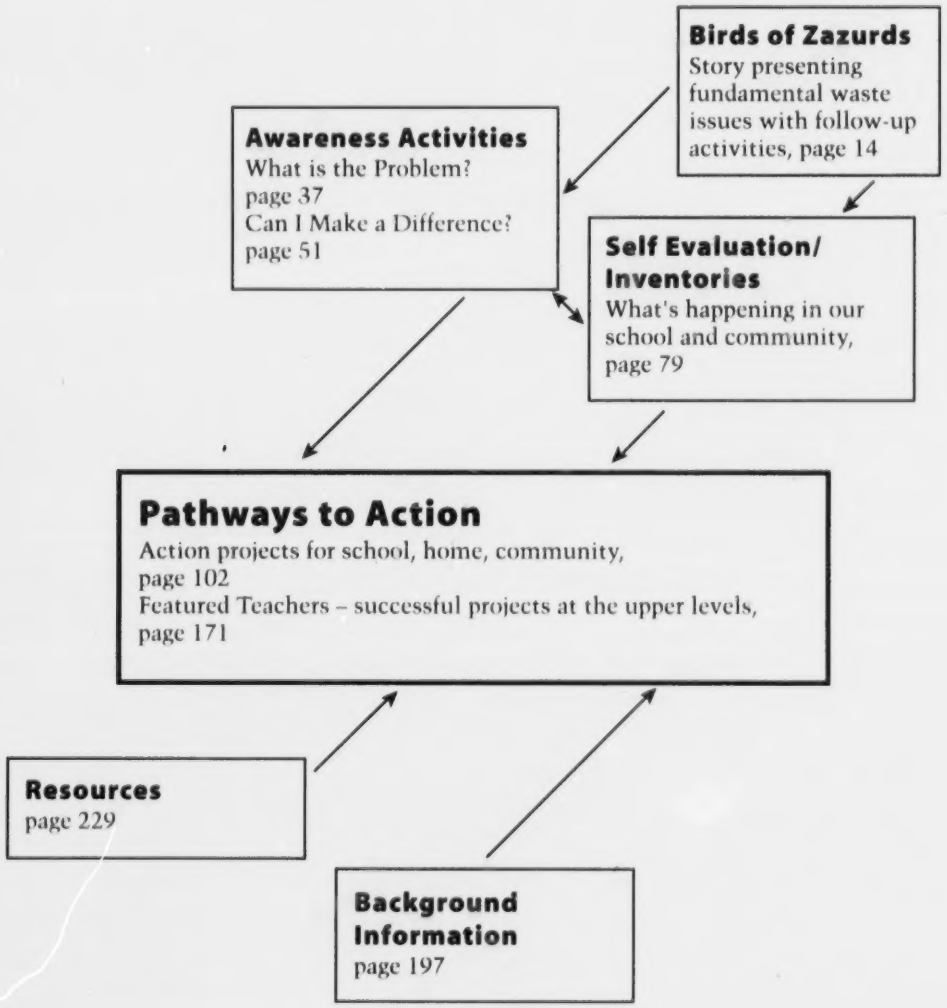
Young people need a chance to express their fears and contribute to the improvement of problems around them. They gain power over their fears by taking steps to help the earth. As children take action, they feel less helpless about their ability to make a difference and more hopeful about the future. As children solve problems, they gain a confidence that solutions can be discovered, and develop healthy self esteem about their ability to find solutions. This is empowerment.

The Pathways to Action section of this guide describes action projects that help students make a difference in the world around them. These are projects that they themselves might well suggest when they identify the pressing waste problems of the school, their homes, or community. Taking action steps to solve the problems they think are important gives students the power and confidence that will lead them on the Pathway to a Sustainable Future.

Flow Chart

Pathways to a Sustainable Future

Each section of the Pathways *program can stand on its own. Teachers can "hop on" at any point appropriate for their students. The ultimate goal is to take action to help solve part of the waste problem at your school, your home, or in your community.* ***All activities lead to a Pathway to Action!***


Birds of Zazurds
Story presenting fundamental waste issues with follow-up activities, page 14
Awareness Activities
What is the Problem? page 37
Can I Make a Difference? page 51
Self Evaluation/ Inventories
What's happening in our school and community, page 79
Pathways to Action
Action projects for school, home, community, page 102
Featured Teachers – successful projects at the upper levels, page 171
Resources
page 229
Background Information
page 197

The Birds of Zazurds

A Story About Waste and Action

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

"The Birds of Zazurds" may seem too advanced for some Kindergarten and First Grade classes. The Lorax by Dr. Seuss is an alternative introductory story to introduce the issues of caring for the environment and looking at our behavior.

Advanced level students may be motivated by anticipating a presentation to younger students.

by Andy Barker
illustrated by Josephine Ewing
© 1993 The Chewonki Foundation

The Birds of Zazurds introduces students to some of the basic waste issues of our time. Written in the spirit of Dr. Seuss, the story takes the Zazurds Backwards Flutter Birds from their idyllic origins in the Gulligut tree, to their environmental crisis, the big crack. Students suggest solutions as the new generation of Birds comes to grips with their problem. Follow-up activities help the students relate the Birds' experience to their own school and community. The Birds of Zazurds Play gives intermediate students the chance to share the story with younger classes.

This story can raise many additional environmental issues for students. The discussion questions do not address the obvious population problems created by the Birds. Teachers are encouraged to explore topics of interest with students even if they are peripheral to the topic of solid waste.

Overview

The story is a good beginning for most classes to look at waste issues in general and see what problems they have around them. Reading the story will motivate students to ask "What about us?" The discussions and activities will get them to start thinking "What can we do?"

Discussion Questions 32

Follow-up Activities

Our School the Gulligut Tree ● 33
Overview: This is a project where students make drawings to compare the Gulligut tree and their school. The drawings show how the Birds of Zazurds and people dispose of their waste.

The Birds of Zazurds Play ■ 34
Overview: Students dramatize the Birds of Zazurds and put on a play for younger classes.

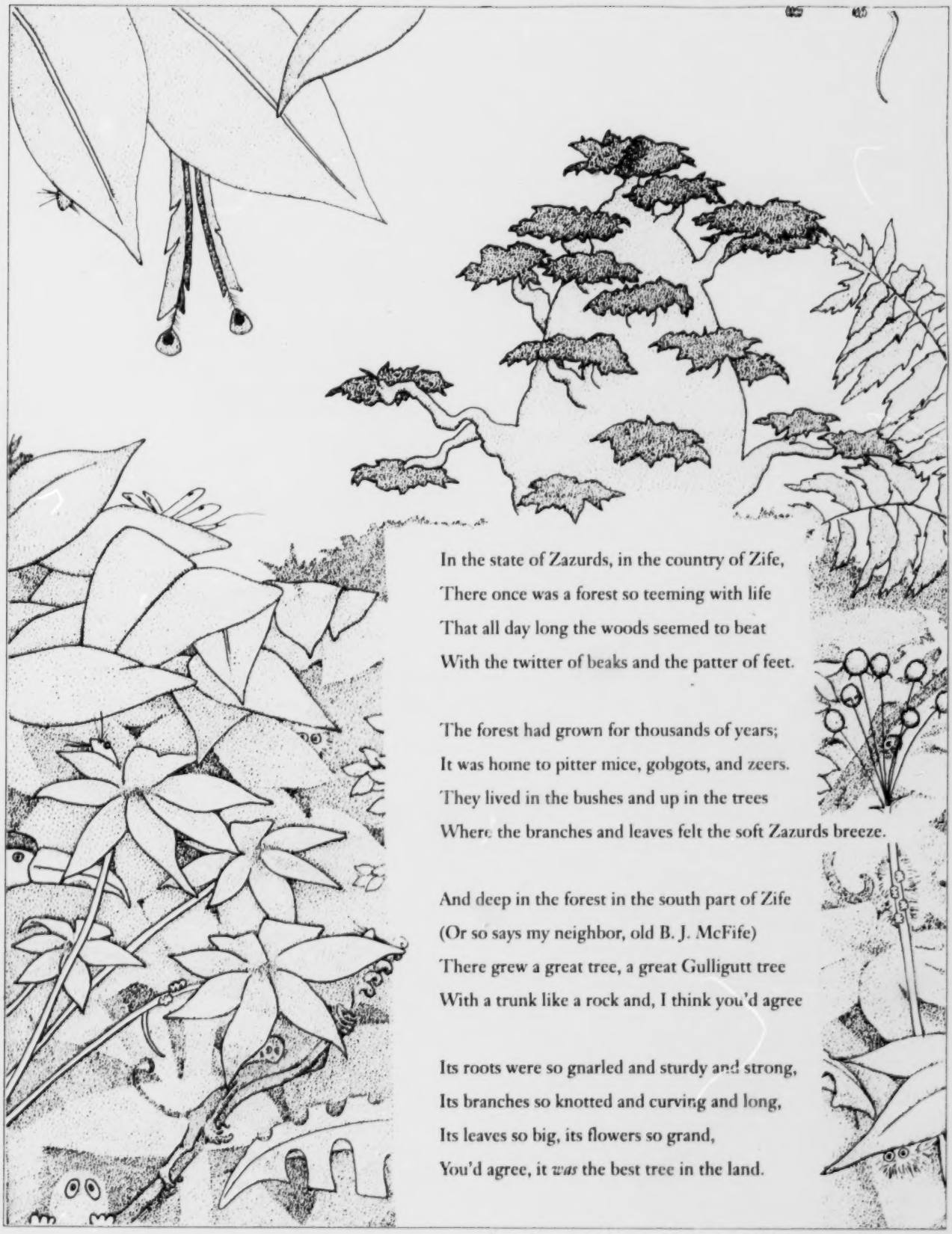
Zazurds II ◆ 35
Overview: Students write and illustrate a sequel to the story "Birds of Zazurds."

Time Planning

The story takes about 30 minutes to read, including the two breaks for discussion. This may vary according to the age group. Some teachers of young students prefer to break in the middle of the story, then complete the reading and discussion later.

The final discussion takes about 10 minutes.

Plan a separate period(s) for the follow-up activities.



In the state of Zazurds, in the country of Zife,
There once was a forest so teeming with life
That all day long the woods seemed to beat
With the twitter of beaks and the patter of feet.

The forest had grown for thousands of years;
It was home to pitter mice, gobgots, and zeers.
They lived in the bushes and up in the trees
Where the branches and leaves felt the soft Zazurds breeze.

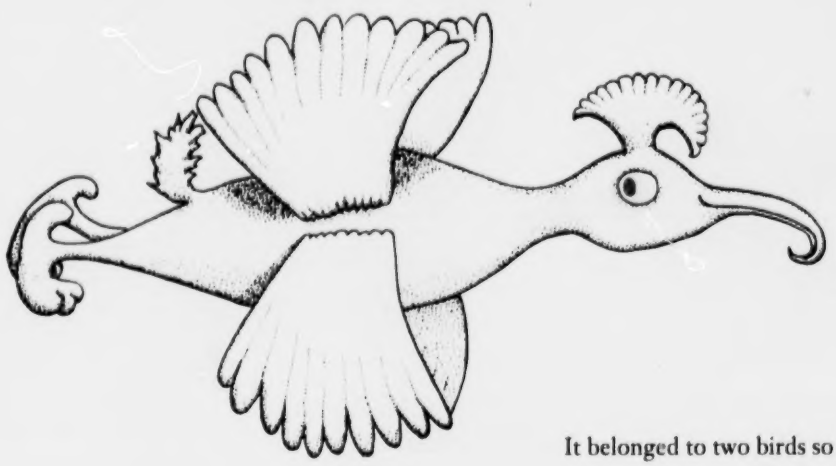
And deep in the forest in the south part of Zife
(Or so says my neighbor, old B. J. McFife)
There grew a great tree, a great Gulligutt tree
With a trunk like a rock and, I think you'd agree

Its roots were so gnarled and sturdy and strong,
Its branches so knotted and curving and long,
Its leaves so big, its flowers so grand,
You'd agree, it *was* the best tree in the land.

And way up high in the tip-tippy-top
Of that Gulligutt tree, something was propped.
It was a nest! Like no other nest
One hundred miles east or one hundred miles west!

The nest was quite simple, made of twigs and dry mud;
It kept out the rain in the heaviest flood;
It was soft on the inside and tough on the out;
The top was quite skinny, the bottom quite stout.

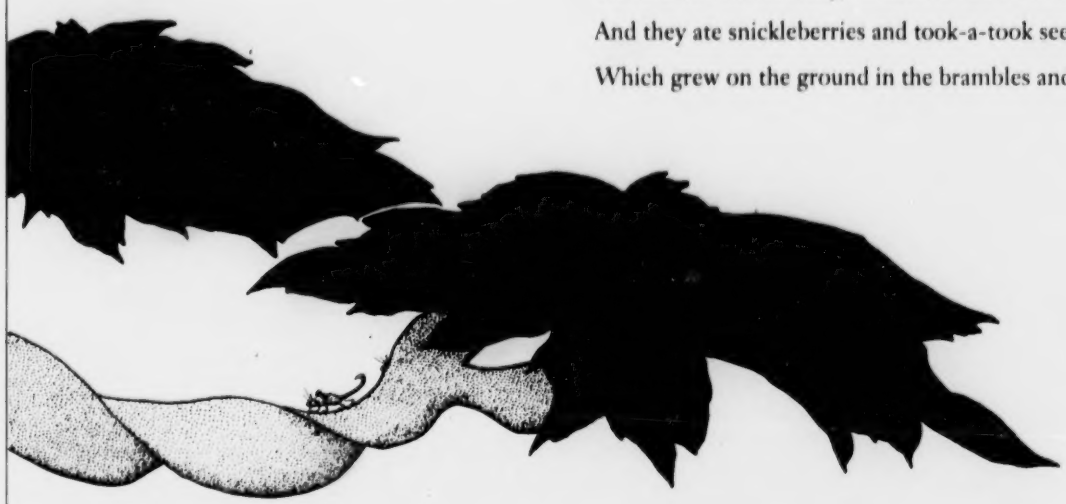
And the nest was so big, so heavy and bold,
That only this tree, or so I've been told,
Only this tree could hold up the nest
All day and all night, without any rest.

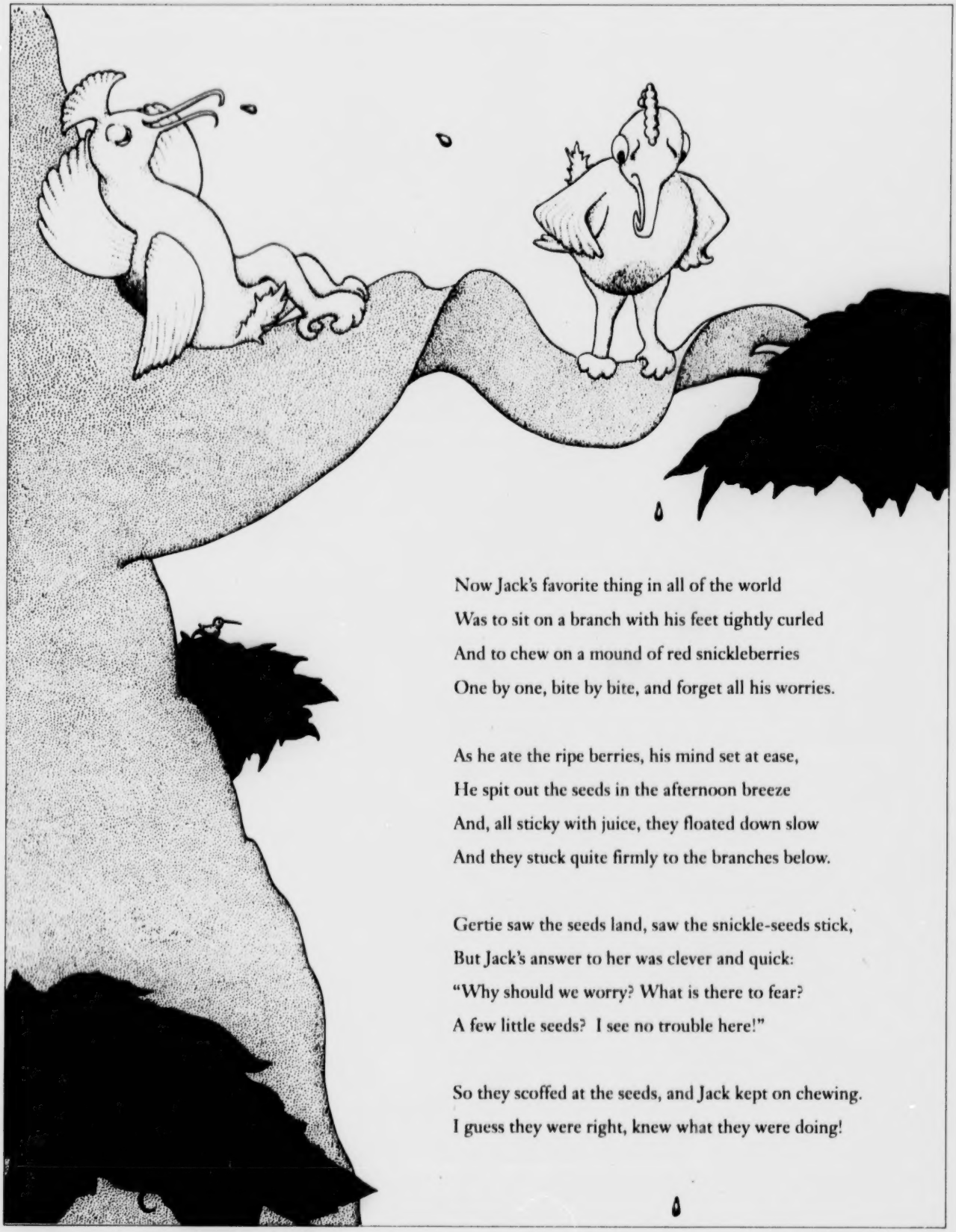


It belonged to two birds so rare in that land
You could count on the fingers of only one hand
And still count them all, in the whole land of Zife,
In the whole living world (or so says McFife).
And though it sounds odd, though it's downright absurd,
They were called the Zazurds Backwards Flutter Birds!

They flew on four wings with their tails going first,
Their heads going last, and their feet in reverse.
And that might be a hint why just two of these birds
Lived in that Gulligutt tree in Zazurds.

One's name was Gertrude and one's name was Jack
She had red on her belly, he had red on his back.
And they ate snickleberries and took-a-took seeds
Which grew on the ground in the brambles and weeds.





Now Jack's favorite thing in all of the world
Was to sit on a branch with his feet tightly curled
And to chew on a mound of red snickleberries
One by one, bite by bite, and forget all his worries.

As he ate the ripe berries, his mind set at ease,
He spit out the seeds in the afternoon breeze
And, all sticky with juice, they floated down slow
And they stuck quite firmly to the branches below.

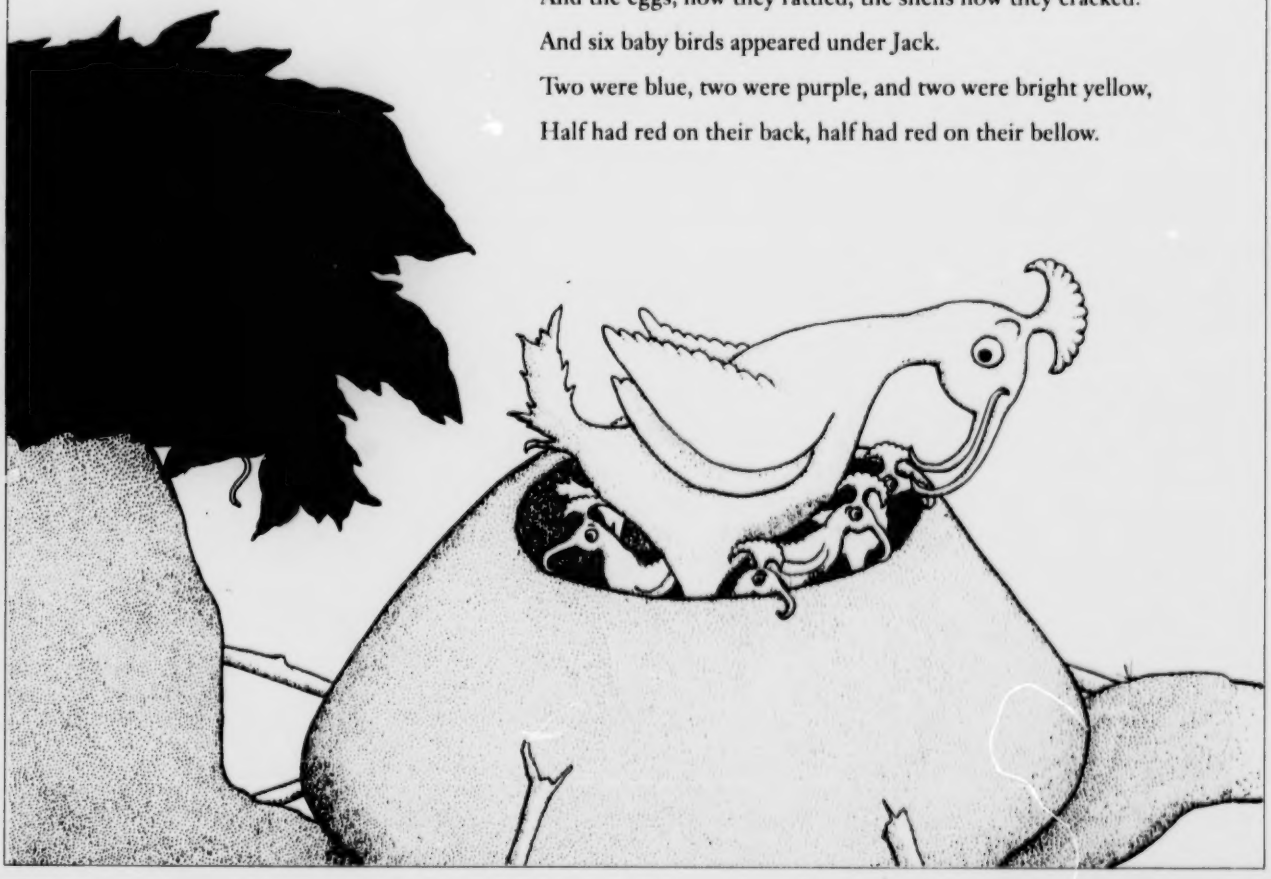
Gertie saw the seeds land, saw the snickle-seeds stick,
But Jack's answer to her was clever and quick:
"Why should we worry? What is there to fear?
A few little seeds? I see no trouble here!"

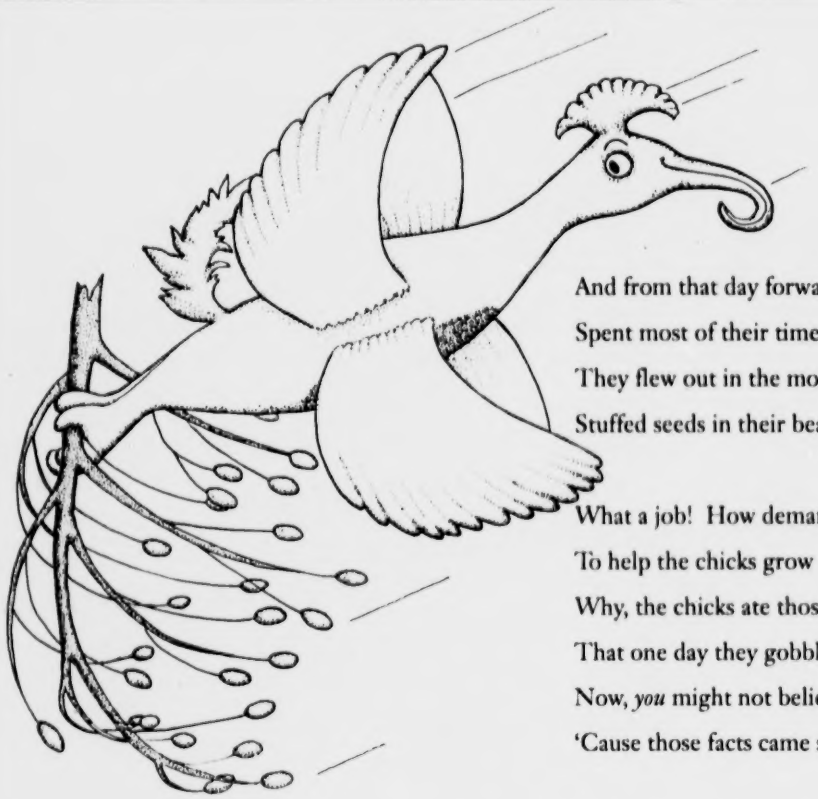
So they scoffed at the seeds, and Jack kept on chewing.
I guess they were right, knew what they were doing!

Now one day as Gertrude perched in the tree
She suddenly felt a twitch in her knee.
The twitching and itching grew, and it grew
Her face turned yellow and purple and blue
And she started to think she was losing her legs
When in fact, she was... yes!... she was laying some eggs!

The first two were yellow, all shiny and new.
The next two were purple, the last two were blue.
And Jack, with a smile, nestled down in the nest
And all winter and spring, warmed the eggs with his chest.

Finally, one morning, the 13th of May,
Gertrude said, "Honey, today is the day!"
And the eggs, how they rattled, the shells how they cracked!
And six baby birds appeared under Jack.
Two were blue, two were purple, and two were bright yellow,
Half had red on their back, half had red on their bellow.





And from that day forward, young Gertrude and Jack
Spent most of their time flapping forward and back,
They flew out in the morning, gathered up food,
Stuffed seeds in their beaks, and returned to their brood.

What a job! How demanding! It took all day long
To help the chicks grow to be healthy and strong.
Why, the chicks ate those berries at such a fast rate
That one day they gobbled six hundred and eight!
Now, *you* might not believe that, but I'd bet on my life,
'Cause those facts came straight from old B. J. McFife!

And B. J. says it's true that those Birds of Zazurds
Would not stop at seconds or even at thirds,
They would always eat fourths and usually fifths
And one bird, once, had seventy-sixths!

So Gertrude one day developed a plan
To speed up the process of feeding her clan.
She stopped stuffing berries inside of her cheeks
And instead plucked whole branches off trees with her beak.

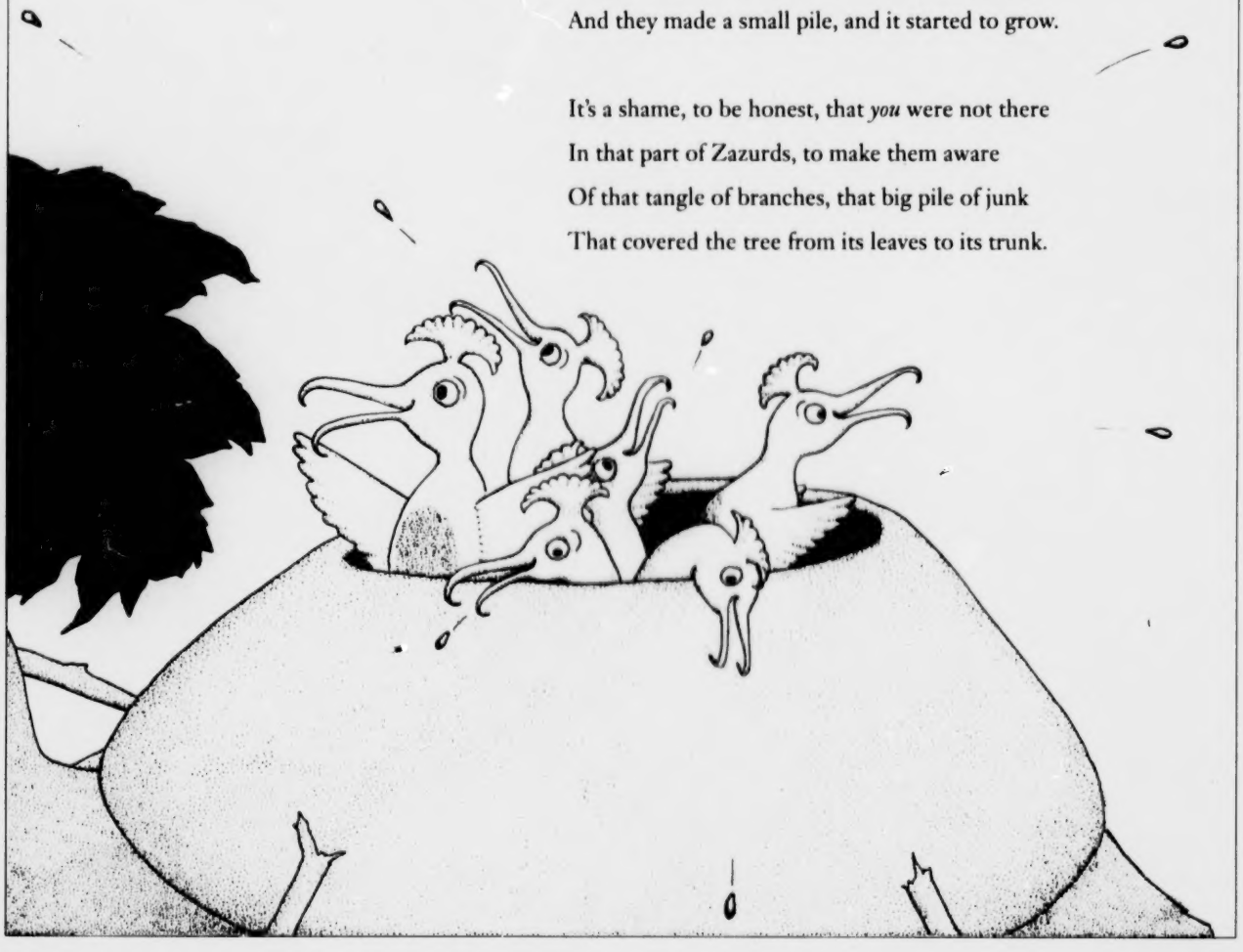
Then she could fly with the branch in her feet,
The limbs trailing ahead, as she flew in retreat.
Sometimes the branches would hold fifty berries!
Enough to feed all of her chicks in one carry.

And though this was handy, though it saved lots of time,
I'll bet there's a question that weighs on your mind:
"What did they do with the branches and seeds
Left at the end of their whole-family feeds?"

Well, the little birds did what their Daddy would do:
They spit out the seeds with a loud, "Puh-puh-TOO!"
And they threw all the branches right out of the nest,
Without really knowing where they all came to rest.

But I'll bet *you* know! You know where they landed!
They got caught in the Gulligutt tree, and were stranded.
They stuck to the limbs of the tree down below,
And they made a small pile, and it started to grow.

It's a shame, to be honest, that *you* were not there
In that part of Zazurds, to make them aware
Of that tangle of branches, that big pile of junk
That covered the tree from its leaves to its trunk.



Then you could have said, "What a terrible mess!"
And demanded they clean it, though I must confess
I'm not sure those messy old Birds of Zazurds
Would have paid much attention to anyone's words.

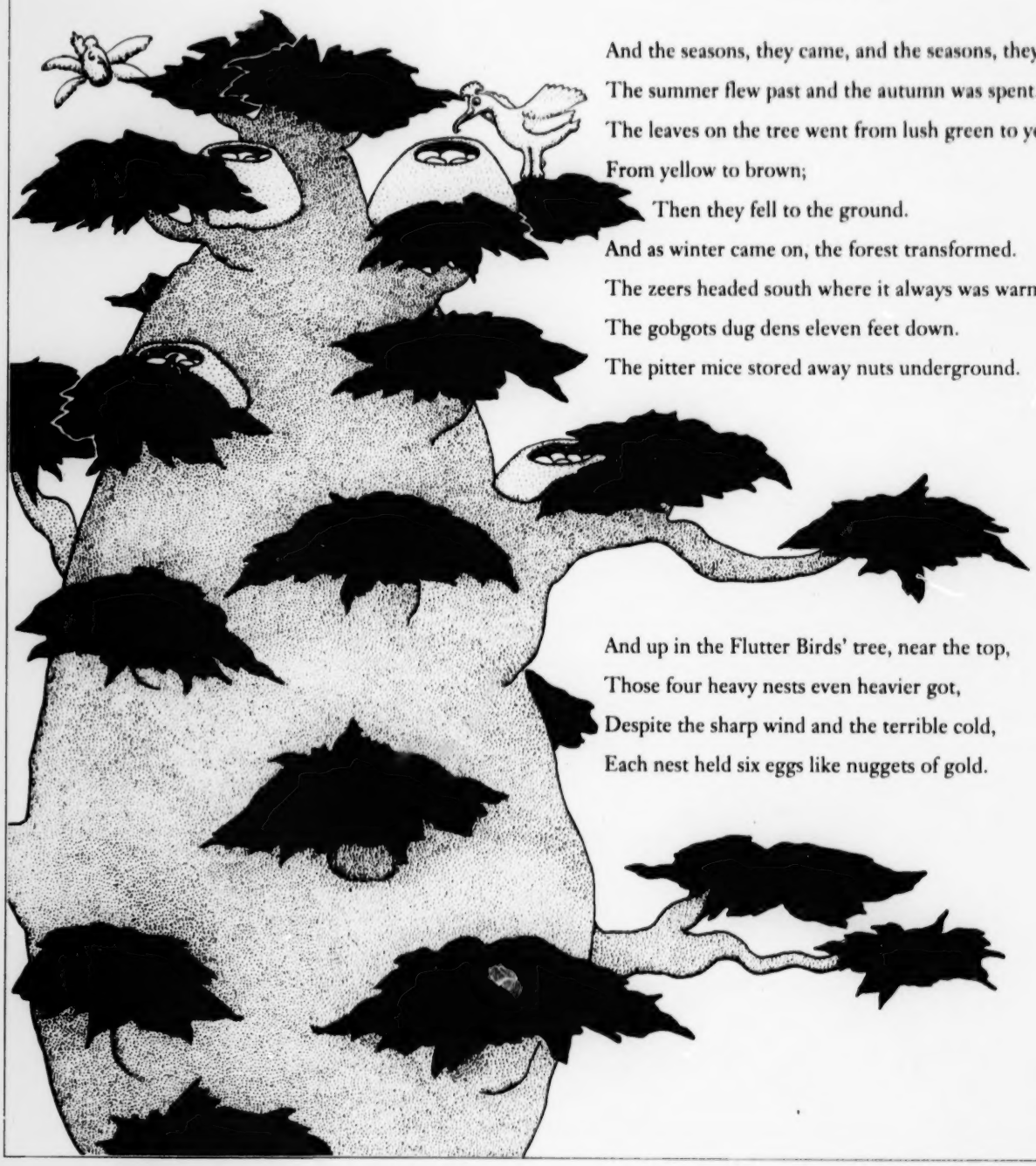
They would surely have smiled and thanked you profusely
And said to themselves as they brushed you off loosely,
"Why should we worry? What is there to fear?
A few little sticks? We see no trouble here!"

So Gertrude and Jack brought more branches back.
It saved lots of time, which let them relax.

BREAK FOR DISCUSSION (optional)

Well, those young Flutter Birds were not young for long.
Their bodies grew solid, their feathers grew strong.
And soon, one by one, they leaped from the nest,
Thrust forward their feet, and puffed up their chests,
They flapped all four wings and let out a cry
And fluttered away in the blue Zazurds sky.

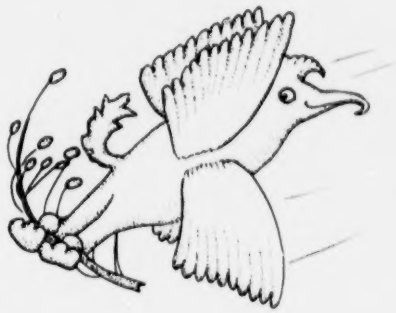
So I asked McFife if Gertie and Jack
Were afraid that their children might never come ba
But B. J. said, "No! Not afraid in the least!
Did you forget? From Southwest to Northeast,
No other tree in the world could support
The weight of a nest of the Flutter Birds' sort.
So those young Flutter birds would as surely be back
As their mother was Gertrude, as their father was Jack."



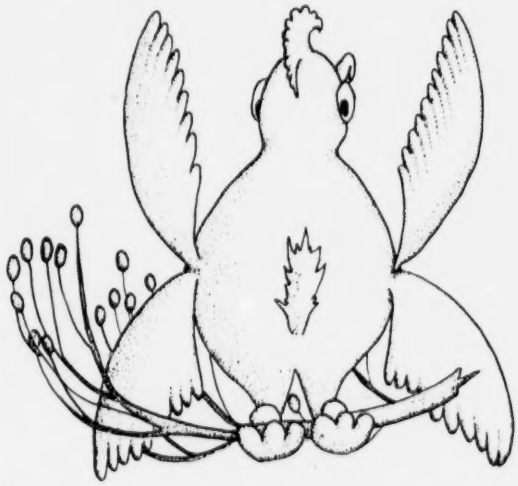
And B. J. was right, all the young birds returned
And Gertrude and Jack were quite unconcerned.
And those two proud parents were happy to see
That several new nests soon appeared in the tree.

And the seasons, they came, and the seasons, they went.
The summer flew past and the autumn was spent.
The leaves on the tree went from lush green to yellow,
From yellow to brown;
Then they fell to the ground.
And as winter came on, the forest transformed.
The zeers headed south where it always was warm.
The gobgots dug dens eleven feet down.
The pitter mice stored away nuts underground.

And up in the Flutter Birds' tree, near the top,
Those four heavy nests even heavier got,
Despite the sharp wind and the terrible cold,
Each nest held six eggs like nuggets of gold.

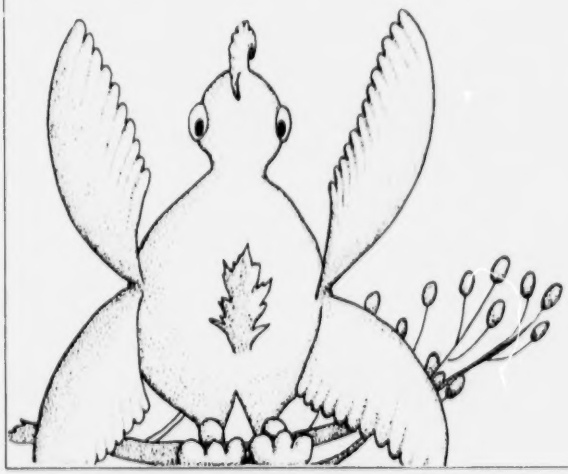


And when springtime returned and brought back the zeers,
When the gobgots woke up and the mice reappeared,
Those Flutter Birds' eggs all trembled, all cracked,
And made proud grandparents of Gertrude and Jack.



Then the forest was filled with melodious peeps
With melifluous chirps and harmonious cheeps
You could hear that marvelous noise throughout Zife,
Or so says my neighbor, old B. J. McFife.

And now all the mommies and now all the daddies
Flew out to find took-a-took seeds for their laddies
They carried back branches, they carried back sticks
Which were bursting with berries and heavy, like bricks!

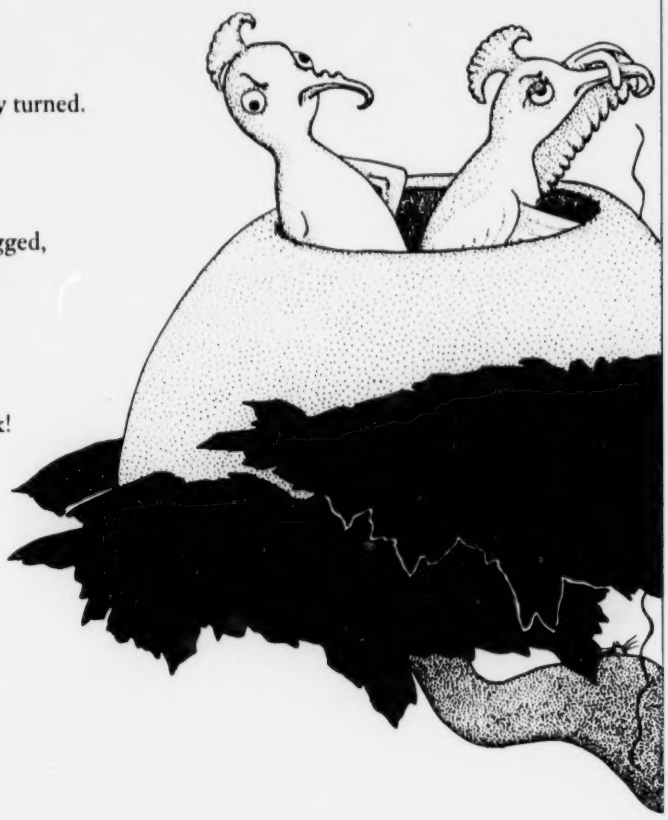


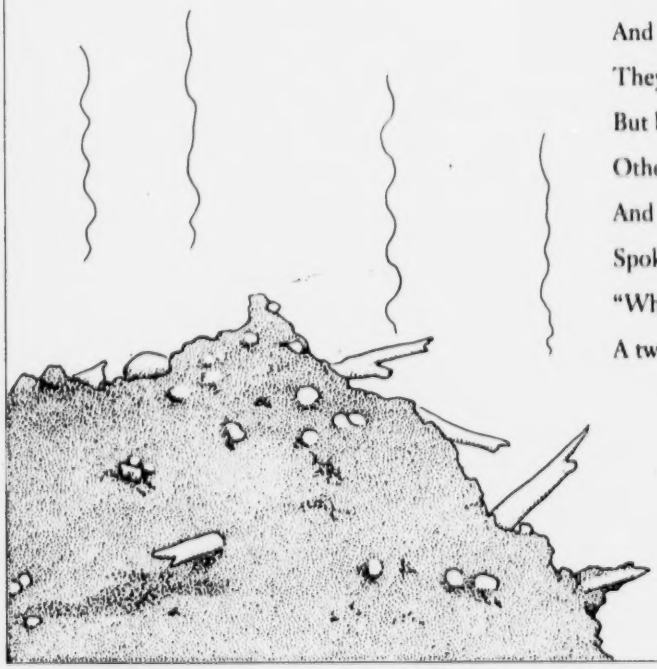
And when the birds finished with chewing their food,
They spit out the seeds —which *I* think is quite rude—
And they threw down the stems without thinking at all.
Now, the pile beneath them was no longer small.

And sometime that summer, the new generation
All learned how to fly, all flew off in formation
And nobody worried, they all soon returned,
And they all built their nests, and the seasons, they turned.

Fall brought the colors and winter brought eggs,
Spring brought new chicks who hungered and begged,
And summer brought plenty of berries and play
And though I hate to admit, I really should say...
That terrible, horrible thicket of junk,
Well, it grew, and it grew, and it grew, and it stunk!

And that's how it went, just exactly like that,
The year after that, and the year after that!
The birds built their nests, the junk pile got fat,
The year after that, and the year after that.





And each year there were birds who would look at the pile,
They would look at the seeds, now rotten and vile,
But before they could shout, "This pile's a disaster!"
Other parts of their brain would work slightly faster
And remember the words from many years back
Spoken by great-great-great- grandfather Jack:
"Why should we worry? What is there to fear?
A twenty-foot pile? I see no trouble here."

But....
I guess they were wrong! They didn't know squat!
What they did to that tree was not right. It was not!

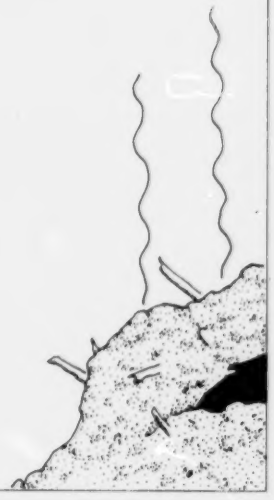
And I wonder what ancestors Gertrude and Jack
Would have said if they'd heard the terrible CRACK!
Would have said if they'd seen the tree leaning back
Would have said if they'd seen all those branches go slack.

It just was too much! Too much weight weighing down!
It's a wonder that tree didn't fall to the ground!
But fall it did not! It stood right in its place
Now, without the same strength and without the same grace.

But that crack was a warning to those Birds of Zazurds
A warning that 20 foot piles are absurd!
And they'd better get working to clean up their mess
Before worse things occurred and the problem progressed.

So they did get to work, they heeded the warning,
They made up their plans that very same morning.
They all stopped their playing, stopped flying, stopped eating,
They flocked to the tree and they held a great meeting.

BREAK FOR DISCUSSION OF POSSIBLE SOLUTIONS



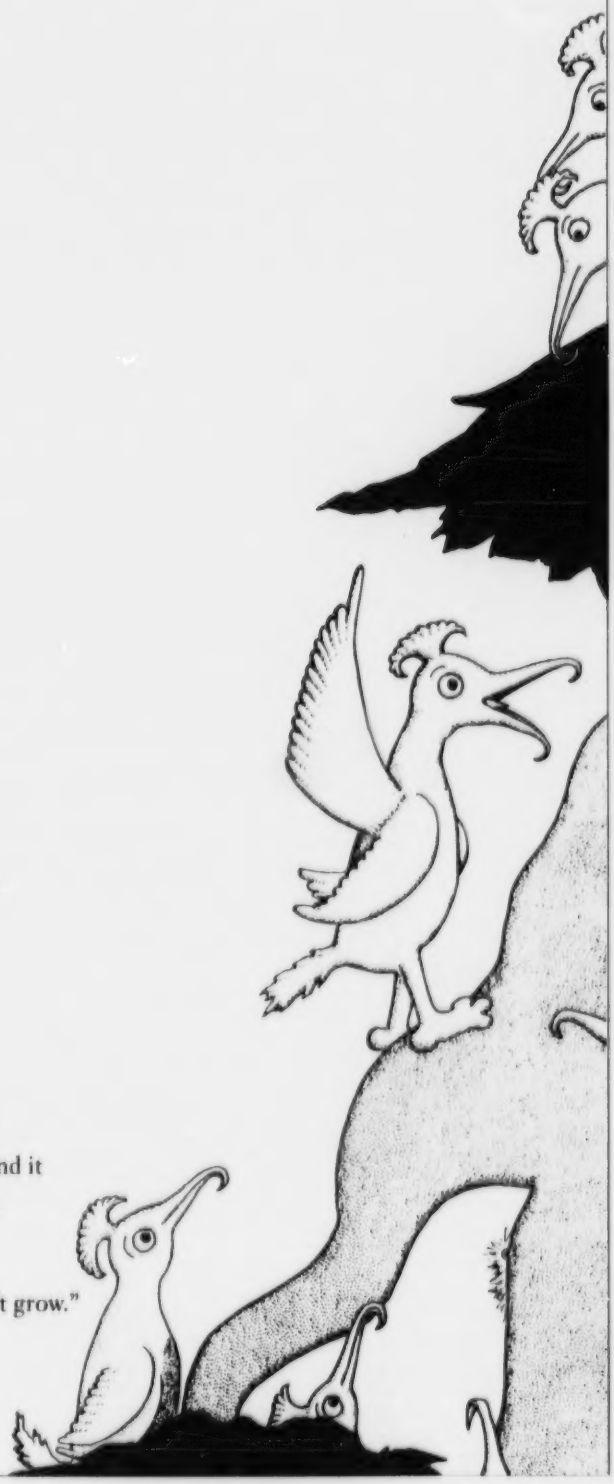
Now the first plan was brilliant, it came from a bird
Named Jack Junior Jack Junior Jack Junior the Third
And Jack was descended completely directly
(You've probably already guessed it correctly)
From the very first Gertrude and very first Jack
Who settled that tree oh so many years back.

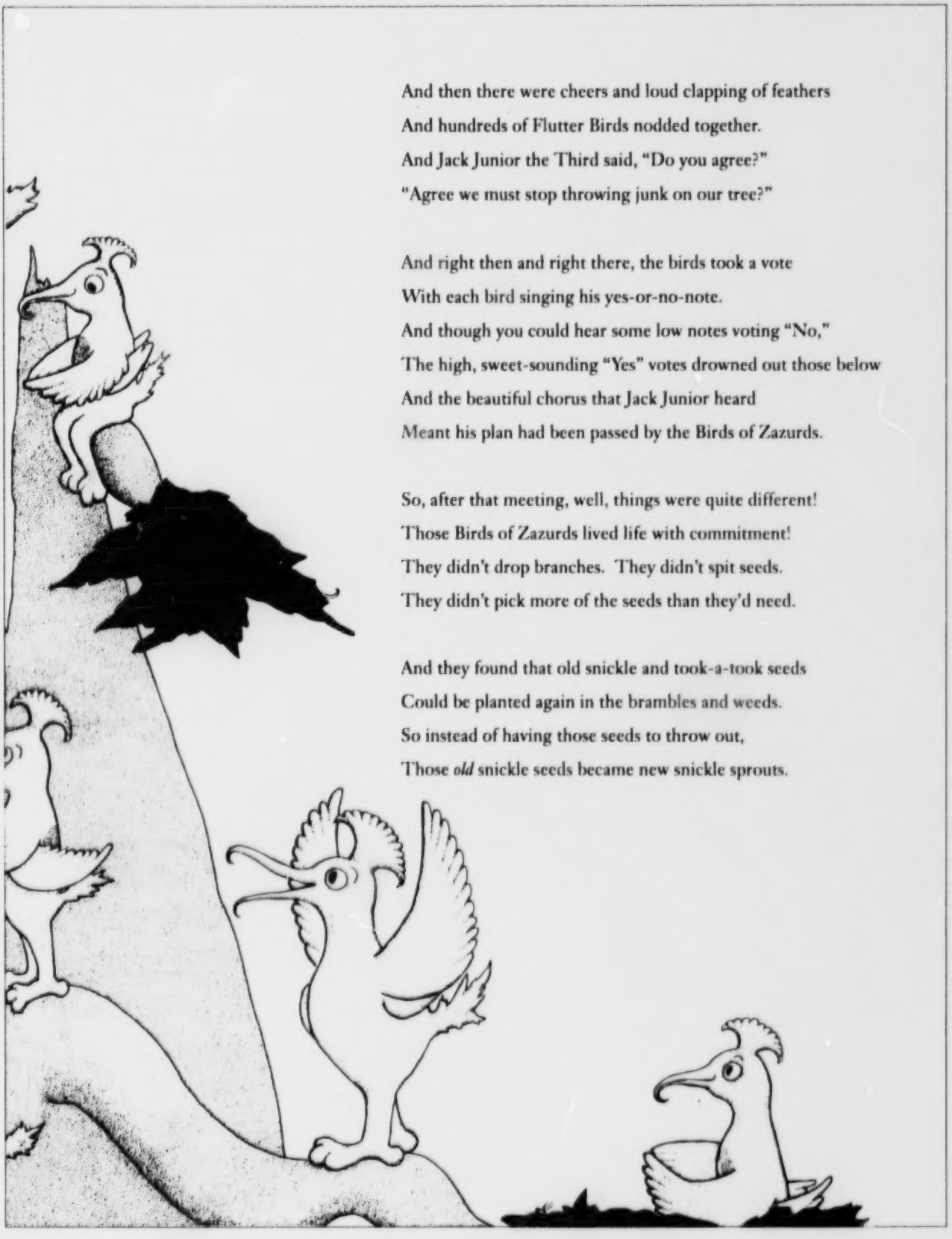
And Jack Junior the Third spoke to all of the birds
And he spoke very loud so his words could be heard.
He said, "Friends, the first thing I'll tell you today
Is that we must change how we throw things away!"

"Spitting out seeds is a thing of the past!
Throwing out branches must end now, at last!
For all of this time it has seemed to be free
To throw all our junk on our Gulligutt tree."

"But free it is not! It has a huge cost
Our very own Gulligutt tree may be lost!
And in some parts of Zife, the forest is bare
And took-a-took plants have become downright rare."

"So I say to you all, my family and friends,
This is the plan that I now recommend:
Don't pluck off a *whole* branch of took-a-took seeds,
Only take a small twig with the seeds that you'll need.
And the leftover branch? Clamp your beak right around it
And return it right back to the place that you found it!
Then the thicket of junk that lurks down below
Won't expand won't increase, won't enlarge, and won't grow."





And then there were cheers and loud clapping of feathers
And hundreds of Flutter Birds nodded together.
And Jack Junior the Third said, "Do you agree?"
"Agree we must stop throwing junk on our tree?"

And right then and right there, the birds took a vote
With each bird singing his yes-or-no-note.
And though you could hear some low notes voting "No,"
The high, sweet-sounding "Yes" votes drowned out those below
And the beautiful chorus that Jack Junior heard
Meant his plan had been passed by the Birds of Zazurds.

So, after that meeting, well, things were quite different!
Those Birds of Zazurds lived life with commitment!
They didn't drop branches. They didn't spit seeds.
They didn't pick more of the seeds than they'd need.

And they found that old snickle and took-a-took seeds
Could be planted again in the brambles and weeds.
So instead of having those seeds to throw out,
Those *old* snickle seeds became new snickle sprouts.

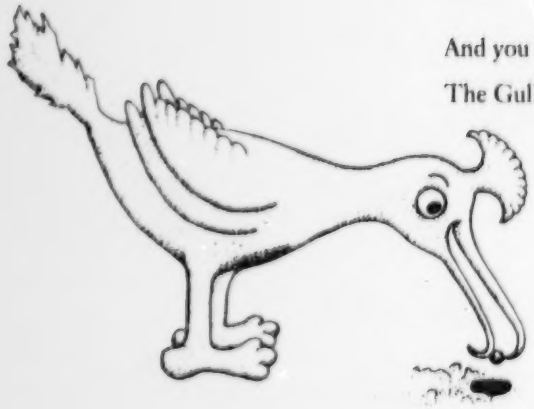
And the Birds of Zazurds planted every last seed
That once had been stuck to their Gulligutt tree
So that snickle and took-a-took plants did abound
And they covered the forest for miles around.

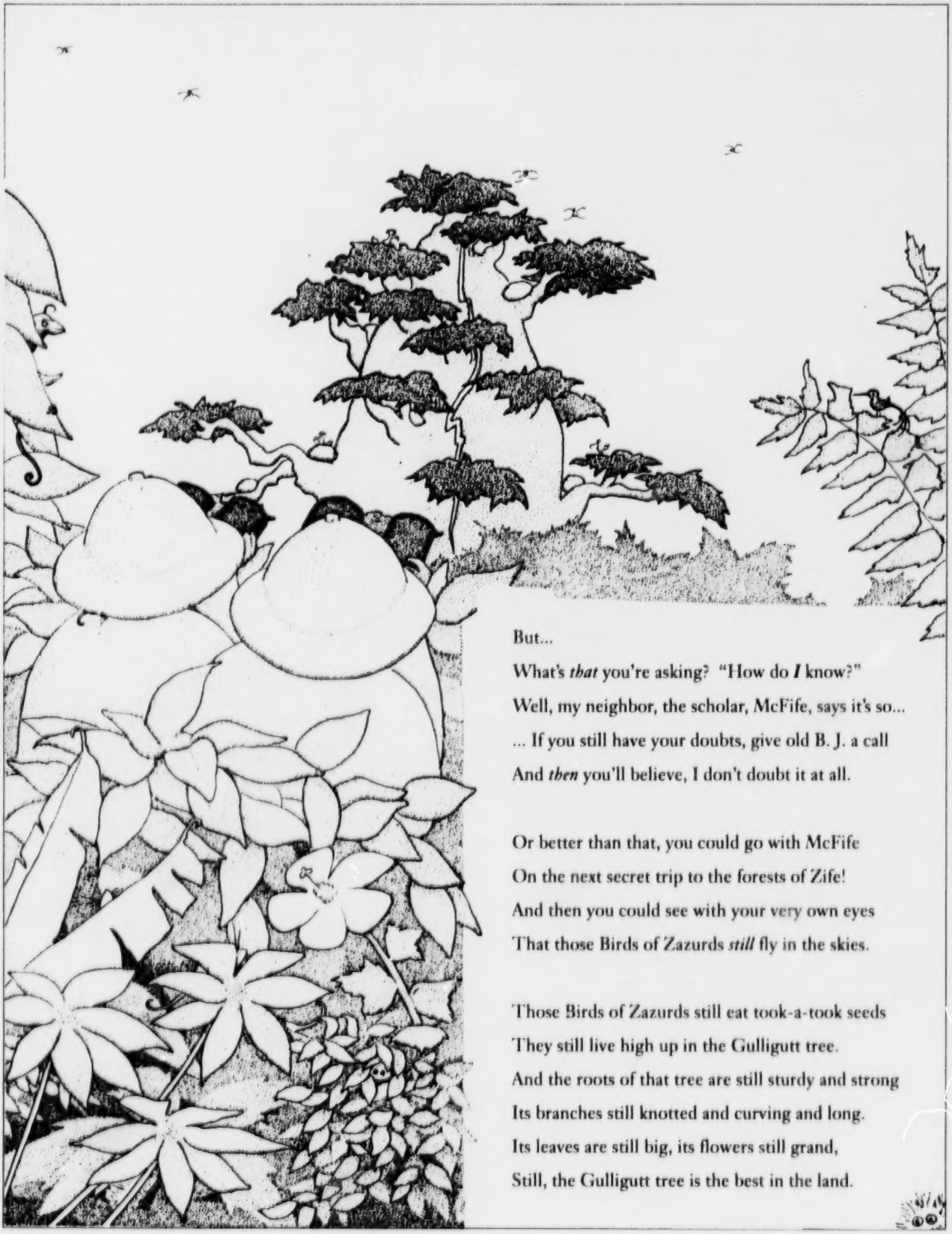
And it took a long time; it took several years
But soon all the Gulligutt branches were clear!
And then, after that....Well, would you believe?
The Gulligutt tree heaved a sigh of relief
And the Birds of Zazurds, well, they started to sing,
For they knew they had done the exactly right thing!

Then the birds sang quite often, they sang sweet and loud
They sang mostly because they were happy and proud.
By working together, by having a plan,
They had rescued their tree, they had rescued their clan!

And one day when Flutter bird Gertrude FlipFlupper
Was planting some seeds leftover from supper,
She fluffed up her feathers and threw back her head
And with pride in her voice, she truthfully said:
"No reason to worry! No reason to fear!
The pile is gone! There is no trouble here!"

And you know, she was right! There was nothing to fear.
The Gulligutt tree was out in the clear.





But...
What's *that* you're asking? "How do *I* know?"
Well, my neighbor, the scholar, McFife, says it's so...
... If you still have your doubts, give old B. J. a call
And *then* you'll believe, I don't doubt it at all.

Or better than that, you could go with McFife
On the next secret trip to the forests of Zife!
And then you could see with your very own eyes
That those Birds of Zazurds *still* fly in the skies.

Those Birds of Zazurds still eat took-a-took seeds
They still live high up in the Gulligutt tree.
And the roots of that tree are still sturdy and strong
Its branches still knotted and curving and long.
Its leaves are still big, its flowers still grand,
Still, the Gulligutt tree is the best in the land.

Discussion

First Discussion Session

After the line ...It saved lots of time which let them relax.

1. What are the major problems facing the Birds?
2. Who (or what) is responsible for these problems developing?
3. What do you think might happen next?

Second Discussion Session

After the line ...They flocked to the tree and they held a great meeting.

1. Why are the Birds having a meeting?
2. What are the problems now? (add ideas to the list)
3. What solutions do you think will help the Birds?

Final Discussion

If there was no discussion during the story, use the factual questions above to begin the final discussion

● Introductory

1. What things did the Birds do to create their problem?
2. Was there a problem when there was only one nest? How did more nests and more birds make the problem worse?
3. What were the other problems facing the Birds?
4. What solutions did the Birds devise? Were they the same as yours? What other suggestions would you have for the Birds to solve their waste problem?
5. Why was it important for the Birds to change the way they threw things away? What other things did they have to do differently? Why wouldn't it have worked to have someone just take the mess "away"?
6. How did the solutions to the problems change the Birds' lives? Did it make their lives easier or harder? Was their life better? How?
7. What was special about the Gulligutt tree? Why did the young Birds return to the tree?
8. How are the Birds of Zazurds like people? How is the Gulligutt tree like your school? Your home? Your town?
9. Do people in your classroom (your school, your family) do things that might harm your Gulligutt tree?

■ ◆ Intermediate and Advanced

1. When did the Birds' trash become a problem? Why wasn't it a problem before that?
2. So, was Jack right at the time when he said, "I see no problem here."
3. What were the effects of increasing population?
4. How did the Birds' behaviors make their lives easier?
5. What solutions did the Birds devise? Were they the same as yours? What other suggestions would you have for the Birds?
6. How are the Birds of Zazurds like people? How is the Gulligutt tree like our homes and community?
7. How are the trash problems of the Birds like the problems people face?
8. What can we learn from the Birds of Zazurds?
9. If you went with B.J. McFife on his next secret trip to Zazurds, what do you think you would find? How might the Birds have changed since the end of the story?
10. Where do you think Zazurds is? Where is Zife? Who do you think B.J. McFife is?
11. Describe the narrator. How is the narrator like you?
12. Who is your favorite character? Why?

Our School, the Gulligutt Tree

Overview

This is a project where students make drawings to compare the Gulligutt tree and their school. The drawings show how the Birds of Zazurds and people dispose of their waste.

Level
● *Introductory*

Materials
drawing paper
crayons

Objectives

Students will compare the Gulligutt tree to their school and identify wasteful behaviors.

Management Suggestions

1. Arrange a short "field trip" with the custodian to the dumpster and recycling area so students can see where the classroom (cafeteria, teacher's room, office) trash goes. Have the custodian describe where the trash goes from there.
2. Use the discussion following the story to focus the ideas for the drawings.
3. Consider doing small group drawings or a single class mural.

Procedure

1. Read the Birds of Zazurds and discuss the story using the discussion questions.
2. On a flip chart or on the board, make two columns: on one side brainstorm a list of items the Birds threw away, on the other side make a list of things that are thrown away in the school. Compare the lists and discuss similarities.
4. Take a quick trip with the custodian to see where trash from the classroom (and other parts of the school) goes. Are things being done to reduce the amount of trash thrown out?
5. Have students fold drawing paper in half. Label one side "The Gulligutt Tree" and the other side "Our School." Have them draw/color the tree and the school showing the trash produced and disposed of in both places.

Discussion

1. Compare the Gulligutt tree to the school.
2. How are the Birds' habits and your habits similar? Different?
3. How are the tree and the school important "habitats"? Why do we need to care for them?
4. What waste problems do we have in the school?
5. The Birds changed how they did things. Are there things we could do differently?

The Birds of Zazurds Play

Level

■ *Intermediate*

Materials

costumes and props the students devise

Overview

Students dramatize the Birds of Zazurds and put on a play for younger classes.

Objectives

Students will interpret the story of the Birds of Zazurds, relate the story to their own lives and produce a play which demonstrates their understanding.

Management Suggestions

1. Arrange (or have students arrange) with other teachers to perform the play for younger classes in the school. The play might be presented to parents or taken "on the road" to other schools.
2. Avoid writing out lengthy scripts by making copies of the story. Have narrators and characters underline their lines.
3. More advanced groups may want to write more dialog into the story.
4. Try to have a part for each student. Several students can share the part of the narrator.

Procedure

1. Read the story and discuss it to process student understanding of the allegory and help the students relate the Birds to their own lives.
2. Plan the play with students:
   - List the characters
   - Decide who will take each part, including narrator(s) and "extras"
   - Divide the story into "scenes"
   - Brainstorm ideas for props and costumes that would go with each scene
   - Decide on what dialog will be included in each part
   - Experiment with actions that can convey meaning to the story
3. Gather props and costume materials.
4. Practice the play and logistics for putting the play on for others.
5. Plan for discussion with the audience following the play - have students plan appropriate questions.
6. Present the play and facilitate discussion with the audience.

Discussion

1. Discuss how the students' understanding of the story has changed after presenting the p[illegible] to other groups.
2. Brainstorm action steps the students might take to avoid developing problems with waste in school.

Zazurds II

Overview

Students write and illustrate a sequel to the story Birds of Zazurds.

Level

◆ **Advanced**

Materials

materials for writing and drawing

Objectives

Students will analyze the Birds of Zazurds and create a story line which develops the concepts of waste management into another time.

Management Suggestions

1. Arrange (or have students arrange) with other teachers to present their stories to younger classes in the school.
2. To help students understand allegory, have them read and discuss other environmental allegories (for example, The Lorax and the Butter Battle Book by Dr. Seuss.)

Procedure

1. Read the Birds of Zazurds and discuss the story to process student understanding of the allegory, and to analyze the waste management issues presented. Discuss how the problems evolved, what attitudes were responsible for the problems that developed, and how the problems were addressed. Analyze the characters, discuss how realistic they were, and how they could represent people.
2. List additional waste management issues students are familiar with that were not mentioned in the story. Imagine how these issues might be described in a Zazurdian (allegorical) setting.
3. Discuss imaginary scenarios that could take characters or situations into the future, or before the time of the story. It may be helpful to start by taking an imaginary trip with B.J. McFife back to Zife. Students might imagine either a land where problems continue to be dealt with successfully, or where characters create new waste problems. Behaviors of any of the other animals mentioned in the story could be developed, and those animals could interact with the Birds. Consider the same story from the Gobgot's point-of-view, or as it might be told by B.J. McFife.
4. Have students write their sequels in prose or verse. Work individually, in pairs, or in small groups. develop illustrations to accompany the story.
5. Edit and revise the works.
6. Read and discuss the sequels in class to further develop students' understanding of the issues and ideas for solving waste problems.

Follow-up

1. After the writing has been edited and discussed in class, students can read both the Birds of Zazurds and the sequel to younger classes, and lead discussions following the stories.
2. Discuss student understanding of the waste management issues after having presented to other groups.
3. Brainstorm action steps the students might take to avoid developing problems with waste in school, at home, and in the community.

Waste Awareness Activities

Part 1: What Is the Problem?

These activities help students answer the question, "What is the waste problem?" They look at the volume of trash production, lifestyles that contribute to the waste problem, American consumption and resource use.

Level
● Introductory
■ Intermediate
◆ Advanced

Drop in the Bucket ● ■ ◆	**38**
How Much Trash? ● ■ ◆	**40**
Mounting Milk Cartons ●	**42**
If Toys Could Talk ●	**44**
Bread & Kisses ■ ◆	**46**
Getting to the Route of the Hazardous Waste Problem ■ ◆	**48**

What is the Problem?

Drop in the Bucket

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials

large metal wastebasket or other metal container (a washtub is ideal)

bulk pack of BBs or 12 single packs (250 BBs/pack)

stapler with staples

chart with data

cups labeled individual, classroom, school, town, state for holding BBs

Related Activities
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Key Question
What difference does my trash make?

Overview

In this demonstration a single staple represents the waste created by an individual daily, and a metal "BB" represents the waste created by about 200 people. As staples and BBs are dropped into a large hollow container, students get a powerful auditory image of the waste disposed of daily in their school, town, and state.

Objective

Students will compare the amount of trash produced by an individual, a school, a community, and Maine through a concrete auditory model.

Background Information

It is easy to feel like each of us is only a "drop in the bucket" when it comes to the waste problem. The waste each person throws out every day may seem insignificant. But when we look at the accumulation of waste from a larger group, with each person producing 4.3 pounds every day, trash piles up quickly. This table shows how the trash problem is magnified when we look at groups around us.

Daily Waste Generation by Group

	Population	Daily Waste	Pieces of "trash"
Individual Person	1	4.3 pounds	1 staple
Class: Small	18	77 pounds	15 staples
Class: Large	28	120 pounds	24 staples
School: Small	200	860 pounds	1 BB
School: Large	500	1 ton	1 BB
Town	15,000	32 tons	32 BBs
City	100,000	215 tons	215 BBs
State (Maine)	1,250,000	2,700 tons	2700 BBs
Country (U.S.)	225,000,000	480,000 tons	480,000 BBs

In this activity each staple represents about five pounds of trash and each BB represents a ton of trash.

Management Suggestions

1. Staples should be separated and have the points closed, i.e. staple "nothing" to get the staples needed.
2. Count the BBs over a lunch tray or pan to keep them under control.
3. ● **Introductory** - Prepare the staples and BBs ahead of time for the children to count. Mark each cup with the name of the group, the number of pieces, and what each piece represents. You may want to count the staples and BBs ahead of time.
4. ■ ◆ **Intermediate & Advanced** - Students can prepare the staples and BBs themselves. They should mark their cup with group name and scale.
5. Make a chart with the data that represents your school from the chart above adding the name of your class, school, and town. ■ ◆ **Intermediate & Advanced** - You might have the students calculate the numbers of "pieces of trash" themselves, rounding to the closest staple or BB.
6. Post the chart so each group can check the number of items it needs to count.
7. Place the wastebasket so it reverberates when the BBs are dropped; make the sound as dramatic as possible by pouring the BBs very slowly.

Procedure

1. Discuss how much trash each person makes in a day. Read the chart and compare the numbers for each group. Discuss the phrase "drop in the bucket."
2. Divide the class into small groups, each to count out the appropriate number of BBs or staples.
3. Have each group find the number of BBs or staples to count, according to the chart.
4. Have the groups count the number of BBs or staples and collect them in the appropriate cup. Be sure each cup is labeled.
5. Identify each cup and discuss how much trash each staple or each BB represents.
6. Seat students close to the wastebasket ***have them close their eyes***.
7. Announce what the cup represents, e.g. "This sound represents the waste produced every day by each one of us"; ***slowly*** pour the pieces from the cup into the wastebasket.
8. Repeat for the other cups.

Discussion Questions

1. After all the cups have been poured, elicit student reactions to the different sounds, compare amounts of waste generated by various groups in Maine.
2. Does it matter what one person throws away? How?
3. How can an individual, a class, a school, or a town make a difference in how much waste is produced and has to be disposed?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *Used Clothing Drive and Swap*
- *Magazine Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

What is the Problem?

How Much Trash?

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials

scale

box for weighing trash

large bag of assorted, clean trash

calculator

(optional) one 4.3 pound bag of trash for each student

Related Activities

- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*

Key Question
How much waste am I responsible for?

Overview

In this activity, students weigh 4.3 pounds of trash to see how much they generate each day. They pile bags to show how much trash the class as a whole generates in a day and they estimate the accumulated volume of the trash they would produce in a year.

Objectives

Students will show how much trash they are each responsible for producing every day; they will calculate the amount of trash generated in the U.S., Maine, and their community daily and annually; they will analyze the effect of source reduction.

Background Information

Municipal Solid Waste (MSW) includes trash that is thrown away by households and businesses. It does not include industrial, agricultural or mining wastes. In Maine, MSW includes paper, food wastes, metals, yard/wood wastes, plastics, glass, litter/

Municipal Solid Waste Generated & Recycled

(annual figures; ppd = pounds per person per day)

	U.S. (EPA 1991)	Maine (MWMA 1992)
MSW 1960	88 million tons (2.7 ppd)	n/a
MSW 1988	150 million tons (4.0 ppd)	1.36 million tons
MSW 1990/91	195.7 million tons (4.3 ppd)	1.25 million tons
Recycled 1988	11 %	16 %
Recycled 1991	17.1 %	30 %
Goal for Recycling 1994/95	20-30 %	50 %

(Detailed statistics of waste generation and recycling are available from the U.S. Environmental Protection Agency and the Maine Waste Management Agency. Because different agencies include different types of waste in the same type of calculation, it is often difficult to make complete, direct comparisons between Maine and the United States as a whole.)

diapers, textiles, demolition debris and "other". The U.S. Environmental Protection Agency estimates that each person in the country contributes an average of 4.3 pounds of MSW daily. This translates to over 3/4 ton in a year per person. How much is a ton? How much space does our trash take up? How much of the trash can be recycled?

Management Suggestions

1. Prepare a chart with data that students can use to get information for calculations.
2. Clear an area of the classroom, or use the hallway so students can visualize the amounts of trash calculated. Be as concrete as possible. A typical compact car like a Ford Escort weighs about one ton. Make chalk marks on the wall to indicate the size of a pile.
3. (optional) Collect trash from around the school or from home (one plastic bag for each student and adult in the class). Use gloves when handling uncertain trash. It would be best if each bag could weigh 4.3 pounds, but volume is the most impressive measurement. After the piling activity, plan to separate recyclables from the trash, weigh it to get more data about the school trash, and recycle it!

■ ◆ Intermediate, Advanced

1. Weigh the empty box; if possible adjust the scale to zero with the box in place.
2. Have the students estimate how full the box would be with 4.3 pounds of trash.
3. Students take turns adding to the box until the scale reads 4.3 pounds. This is how much trash each American is responsible for discarding each day.
4. Put the trash into a plastic bag (if possible put a similar amount of trash into bags, one for each student). Estimate how large a pile of bags the whole class would produce each day. How many Escorts would this be?
5. Estimate how large the pile would be in a week; a year.
6. Calculate how much waste your family generates in a day, week, year.
7. Take a "field trip" to the school dumpster. How often does it get emptied?
8. Calculate the weight of the students in the class in tons. How many students does it take to make a ton?
9. Estimate figures of trash production (in tons) for the whole school, town, state, country for a day. Compare to the size of the class.
10. Repeat for a week, for a year.
11. If 50% of Maine's MSW is recycled, how much trash will be eliminated from the waste stream this school year?

Discussion Questions

1. Where does the waste from the school get taken?
2. How much of the school waste is recycled? Is this enough?
3. How much of the waste produced at home is recycled? Is this enough?
4. How can we reduce the amount of waste we generate?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *Used Clothing Drive and Swap*
- *Magazine Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Adapted and rewritten from the Waste Away curriculum with permission from the Vermont Institute of Natural Science, PO Box 86, Woodstock, VT 05091; (802) 457-2779.

What is the Problem?

Mounting Milk Cartons

Level
● Introductory

Materials
milk cartons (rinsed and drained) collected school-wide for a day (week)

large roll paper for tracing student body shapes

markers

glue for attaching cartons to paper

Related Activities
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*

Key Question
How fast does milk carton trash accumulate in our school?

Overview
Students collect large numbers of empty milk cartons from the school lunch program and use the cartons for construction projects. They glue the cartons to their body shape outlines and can calculate the number of "carton people" the school creates every day. This gives them concrete images for the amount of trash they help generate, and they see how fast that trash accumulates. They follow-up by considering ways to reduce the waste, not compromise their health by drinking less milk.

Objectives
Students will show how common disposable items become trash that mounts up and must be discarded.

Background Information
Milk is considered an important and healthy staple of the American diet. Elementary school students often drink two half-pint cartons of milk each school day. Although the cartons provide sanitary, easily handled package for milk, they have many drawbacks. The full cartons take up a lot of delivery truck and refrigerator space. The high level of consumption generates a large amount of non-recyclable trash daily, which needs to be landfilled or incinerated.

Some Maine schools compost milk cartons with other organic cafeteria waste. This is a difficult process, and the plastic coating on the cartons can be a problem in composting.

Maine dairies are exploring alternatives to the disposable plastic coated paper half-pint cartons. Dairies in several states sell alternative half-pint milk packages to schools. One is a returnable, refillable Lexan (plastic) half-pint milk container. The other is a lightweight, recyclable plastic pouch. While there are disadvantages for each of these alternatives, both create less waste and conserve resources. Dairies compete for school milk contracts which makes the industry responsive to consumer demands. Dairies will respond to requests for alternative packaging to reduce waste in school.

Management Suggestions

1. Estimate how many cartons you will need to fill in a student's outline (as many as 60.) Compare this to the amount of milk (and the number of cartons) purchased by the school daily/weekly. Anticipate how long you will need to collect cartons to fill in the outlines of several students.
2. It is more dramatic if enough cartons can be accumulated in a few days or a week (this shows how fast trash is generated.)
3. Collect, rinse, drain, and store milk cartons until enough have been collected.
4. If every student won't get his or her outline drawn, consider how those who get drawn are chosen.
5. **Alternative Projects:** use a wire frame and string cartons together to make a three-dimensional "carton person", or staple cartons together to make a life-like model. Consider making models of other objects - a house, a truck, a table.
6. The object of this activity is not to get students to drink less milk, but to understand how much waste they help create. Follow up by discussing alternatives to using disposable milk cartons.

Procedure

1. Working in small groups, have students draw their body outlines on large pieces of paper.
2. Estimate the number of milk cartons needed to fill in the body shape.
3. Glue cartons to the paper.
4. Count the number of cartons on a figure. Compare to the estimates.
5. Display the "carton people" in a prominent place in the school. Include some facts about how much of the school trash is made of milk cartons. Keep a running tally of the "number of cartons used" on a thermometer-type graph.
6. Plan how you will discard the projects when you take the display down.

Discussion Questions

1. How many milk cartons are used in the school in a day; week?
2. How much does it cost the school to dispose of the cartons produced in a week?
3. Are there other costs to the school in handling or storing milk and the cartons?
4. Are there alternatives to using milk cartons in the school? What are they?
5. What other disposable packages or items are used regularly in the school? How can this waste be reduced?
6. What is the effect of buying the same products over and over and throwing away the packaging again and again?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *Cafeteria Composting Project*

What is the Problem?

If Toys Could Talk

Level

● Introductory

Materials

examples (or pictures) of antique toys

examples of modern toys

Related Activities

- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*

Key Questions

How have toys changed from the days when our grandparents were young? How was our grandparents' waste different?

Overview

Students bring in toys from home and collect "antique" toys from their parents' and grandparents' childhood. They examine the toys and compare how materials have changed over the years. They draw conclusions about how their lives are different from their grandparents'.

Objectives

Students will compare the products they use today to those used by their parents and grandparents; they will describe how lifestyles in our country have changed over time and how the waste we generate has changed over time.

Background Information

Most products, including toys, have changed significantly over the years. Through the early part of the 1900s most toys were made from natural materials such as wood. Handmade toys like whirligigs, bean shooters, yo-yos, and tops were very popular. Over time, commercially manufactured toys like wooden Lincoln Logs™ and Tinker Toys™ became available. In the 1960s, plastic toys began to dominate the market, and the demand for hula hoops, Frisbees™, Lego™, toy guns, and plastic models increased steadily. Today, battery operated and electronic toys are very popular, along with video and computer games.

Children have become a major market for American manufacturers and a whole segment of television entertainment has evolved to promote children's toys and other products. Marketing has created the perception in most Americans that more and more *things* are needed to for us to live a satisfying life. Changes in the way toys are made, in what they can do, in the materials used to produce them, and in the numbers of toys marketed, reflect changes in our society. Toys are a metaphor for the American waste dilemma.

Management Suggestions

1. If possible, have a grandparent visit school to be interviewed by the children. Have the students plan questions to ask or use the questions below to help with the interview.
2. The toys can be used for classifying and grouping activities for young children.

Procedure

1. Have each student bring to school a broken toy or a toy that will be thrown away and (if possible) a toy used by their parents or grandparents.
2. Discuss which toys are their favorites and why.
3. Divide the toys into groups of "modern" and "old fashioned".
4. Compare the two groups - look at and discuss:
   - How many toys do you have, how many toys did your parents (grandparents) have?
   - What materials are the toys made of?
   - How long did the toys usually last?
   - If they break, can they be fixed?
   - Would it be cheaper to fix the toy or buy a new one?
   - When it could no longer be used, what would happen to it?

Discussion Questions

1. How have toys changed since your grandparents were young?
2. Are there more toys around today than there were when your grandparents were young? Why?
3. Do the number of toys affect the amount of waste that is created?
4. Which kind of toys are the most fun to play with? Do you think your grandparents would have said the same thing? Why?
5. How is the toy problem like the problem with too much waste in town?
6. What can you do to REDUCE the amount of waste that has to be thrown away?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Used Clothing Drive and Swap*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Promoting Alternatives to Hazardous Products*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Adapted from AVR Teacher's Resource Guide (1990) with permission from the Association of Vermont Recyclers, PO Box 1244, Montpelier, VT 05601; (802) 229-1833

Bread and Kisses

Level
■ Intermediate
◆ Advanced

Materials
one small loaf of bread, unsliced
chocolate kisses (enough for each student)

Related Activities
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Key Question
How does consumption and life style relate to waste generation?

Overview
This is a simulation where one student (representing the population of United States) receives one fifth of a loaf of bread (the world's food supply) and one fourth of a bag of candy kisses (the world's resources); the rest of the class (the rest of the world) must divide the rest of the bread and candy among themselves. The activity shows the unequal distribution of resources around the world. Students draw conclusions about unequal waste production as well.

Objectives
Students will understand that resources are unequally distributed around the world and that levels of consumption are related to waste generation.

Background Information
People in the United States account for 5% of the world's population, consume 25% of the world's resources, and control 20% of the world's food supply. The U.S. leads the developed world in consumption and production and far exceeds that of the emerging world.

The affluent lifestyles of most Americans lead to the production of far more waste per capita than most other countries in the world. The following chart compares waste generation in cities around the world.

Waste Generation Worldwide
pounds per person per day (ppd)

City	Country	Daily Waste Generation
Chicago	USA	5.00
New York	USA	3.97
Tokyo	Japan	3.04
Hong Kong		1.87
Hamburg	Germany	1.87
Medellin	Colombia	1.19
Calcutta	India	1.12
Kano	Nigeria	1.01

from *Waste Age*, Oct. 1989

Although Americans consume a disproportionate amount of the world's resources, there are many factors to consider before condemning U.S. affluence: Technology, manufacturing capabilities, food and aid supplied to other countries, humanitarian services, and democracy.

Management Suggestions

1. Plan this activity for a time that won't interfere with lunch appetites.
2. Allow for chaos when the world's resources are distributed.
3. If possible, have students wait until the results of the distribution are shared with the whole class before eating the resources.
4. Have additional candy on hand to help ease the feelings of inequity after the discussion is completed.

Procedure

1. Divide the class into two groups, one representing the U.S. and the other representing the rest of the world. The U.S. group should be made up of about five percent of the class (if there are 20 students in the class, one would represent the U.S.)
2. Divide the bread into fifths and the candy kisses into fourths.
3. Explain that the bread represents the world's food supply and the candy kisses represent the world's resources.
4. Give 1/5 of the loaf of bread and 1/4 of the candy to the U.S. group.
5. Toss the remaining bread and candy into the center of the "rest of the world" group and allow them to divide as they see fit.
6. After the group settles down, discuss the results.

Discussion Questions

1. What were some of the feelings in the "rest of the world" group and in the U.S. group as they divided their portions among themselves?
2. Was the distribution fair?
3. Why do Americans consume as much as they do? Is this necessary?
4. How do consumption levels in this country relate to the amount of waste we generate?
5. How does the rest of the world benefit from the use of resources in the U.S.? What role does the U.S. play to improve the lives of others around the world?
6. What would happen if we brought in another 25 people to share the bread and candy? How does overpopulation in the "rest of the world" affect the distribution of resources?
7. How does this activity relate to the real world?
8. What can be done to reduce the inequity?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *Used Clothing Drive and Swap*
- *Magazine Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Adapted from the Waste Away curriculum with permission from the Vermont Institute of Natural Science, PO Box 86, Woodstock, VT 05091; (802) 457-2779.

What is the Problem?

Getting to the Route of the Hazardous Waste Problem

Level

■ Intermediate

◆ Advanced

Materials

diagram of a neighborhood (large chart or student handout)

map of region showing water resources

Related Activities

- *Test the Alternatives*
- *School Hazardous Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Key Question

What's wrong with throwing used oil down the drain?

Overview

Using a diagram of a hypothetical neighborhood, and a map of their own town/region students trace the route hazardous materials would take if they were thrown out in the trash or dumped down the drain. They discuss the dangers of hazardous products, proper disposal, and methods of avoiding their use.

Objectives

Students will describe how their homes are connected to the environment and how disposing of hazardous wastes improperly can harm the environment.

Background Information

Many household products contain ingredients which can be hazardous to people or the environment. These ingredients can be poisonous, flammable, corrosive and/or cause violent chemical reactions. Hazardous products generally fall into five categories: automotive products, cleaning and polishing materials, paint and related solvents, pesticides, and miscellaneous items (batteries, some cosmetics, shoe polish.) Unwanted portions of these products become household hazardous waste.

When hazardous wastes are disposed of improperly, they can contaminate septic systems, groundwater, landfills and incinerators. Waste oil, paint, and batteries are among the worst offenders (see the background information section on Household Hazardous Wastes.) Products that are hazardous to discard are also usually hazardous to use. Reducing our reliance on these materials can improve our health as well as the health of the environment.

As with the management of all waste, the primary goal is to reduce the amount of waste that enters the waste stream, and then to provide for secure disposal. To do this, we all must be aware of which products we use at home and reduce our reliance on those that contain hazardous substances. We also need to dispose of the wastes responsibly.

The products most likely to contain hazardous materials include (but are not limited to):

Cleansers

(the most hazardous examples)

- ***furniture polish***
- ***oven cleaner***
- ***drain opener***
- ***spot removers***
- ***toilet bowl cleaner***

Car Products

- ***motor oil***
- ***antifreeze***
- ***car batteries***

Pesticides

- ***flea powder/collar***
- ***insect repellent***
- ***weed killer***
- ***garden insect spray***

Paint and Paint-Related Products

- ***paint***
- ***wood preservative***
- ***wood stain***
- ***paint brush cleaner***

Other Household Products

- ***ni-cad (nickel-cadmium) batteries***
- ***small, sealed lead-acid batteries (as used in emergency lighting)***
- ***shoe polish***
- ***fingernail polish and remover***
- ***rubber cement***

Management Suggestions

1. Draw a schematic diagram of a neighborhood including houses, a septic field, storm drain on the street, trash cans by the house, car in the driveway, garden, and a transfer station off to the side. Either make a large diagram that can later be put on the bulletin board, or make hand-outs for students.
2. Use topographical maps of your area, town planning maps, or copy the map of your region from the Maine Atlas for students to use to trace water courses and pollution sources.

Procedure

1. Write the categories of hazardous products on the board and help students list (brainstorm) what types of products in their homes contain hazardous materials.
2. In small groups, have students predict what could happen if household hazardous wastes were:
   - thrown out with the trash
   - poured down the drain
   - dumped on the ground
3. On the diagram of a neighborhood have students trace the routes wastes would take if they were thrown out, poured down the drain or dumped on the ground. Draw the routes in different colors.
4. Using a map of the community or area, have students highlight all the water sources close to their homes and school and trace connected sources of water. Highlight any landfills or other possible sources of pollution and water sources that could be affected.
5. Discuss proper methods for the disposal of these products. Emphasize regional collection sites, household hazardous waste collection days, completely using products, and choosing alternative products.
6. Have students write a group paragraph to answer the question, "Knowing what you do about hazardous products, do you think it is important to treat them differently than non-hazardous waste when you throw them out?"

Discussion Questions

1. How can you keep hazardous wastes from polluting your neighborhood?
2. How could it be easier for your family to properly dispose of household hazardous wastes?
3. What hazardous materials are used in the school?
4. What can be done to reduce the amount of household hazardous wastes produced? What can you do?

Additional Related Activity

Adopt a Lake (or a River...) A project in environmental protection based on an ongoing project by Carolyn Murray, Garland St. Middle School, Bangor, Maine. Call for a teacher's guide to this project: provided by the Chemicals in the Environment Information Center, University of Maine, Orono, Maine 04469 (207) 581-2301.

Related Pathways to Action Projects

- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

BEST COPY AVAILABLE

Waste Awareness Activities

Part 2: Can I Make a Difference?

These activities help students identify their roles in waste problems around them, and helps them see some of the possible solutions. Students look at decision-making and relate their decisions to actions they can take.

Level
● Introductory
■ Intermediate
◆ Advanced

Everyday Choices for a Sustainable Future
(Moving Toward Waste Reduction and Pollution Prevention) ● ■ ◆ 52

For Better or Worse ● ■ ◆ 58

Are Ten Better Than One? ● ■ 60

Paper, Plastic, or Cloth ■ 62

Where'd You Get That Can? ■ 71

Test the Alternatives ● ■ 74

Can I Make a Difference?

Everyday Choices for a Sustainable Future

(Moving Toward Waste Reduction and Pollution Prevention)

Level

- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials

A kit containing materials for this activity may be available at the Maine Waste Management Agency. Contact the office of Waste Reduction and Recycling, (800) 662-4545.

Gather the materials, and share them with other teachers in your area.

- **white paper:**
  - **a stack of paper blank on one side**
  - **notepads made from that paper**
  - **crumpled paper from wastebasket**
- **lunch wrappings:**
  - **paper lunch bag**
  - **plastic baggies**
  - **throw-away milk carton**
  - **aluminum foil**
  - **fabric bag**
  - **plastic-covered sandwich holder**
  - **plastic-covered dish**
  - **washable drink-bottle**
- **shopping bags:**
  - **paper bag**
  - **plastic bag**
  - **fabric bag**
- **container of concentrated detergent, regular strength**

(continued next page)

Key Question

How do you know which are the best products to buy when you go shopping?

Overview

This is a comprehensive look at things we do and common products we buy which can either help protect the environment or make waste and pollution problems even worse. In either a game format for two teams and a panel of judges, or in a discussion format, students compare small groups of familiar products and decide which choices would be better for the environment. As each group of items is presented students offer information and opinions and an "expert" adds information about waste production, energy consumption, recycling, and pollution prevention.

Objectives

Students will compare products, decide on the ones that best help to reduce waste and prevent pollution, and relate each item to the waste management hierarchy. Students will evaluate their own behaviors and purchasing decisions.

Background Information

Consumers face a bewildering array of products in the marketplace. How do you decide what to buy? The average consumer considers cost and convenience. Environmentally responsible consumers also consider waste, pollution, and impact on the environment. To look toward a sustainable future, we all must become environmentally responsible citizens and think of how our actions and decisions affect the environment.

The ultimate Pathway to a Sustainable Future is one where we reduce waste, which prevents pollution and protects the earth's natural resources. This pathway follows the Waste Management Hierarchy (WMH) endorsed by the U.S. EPA and revised and adopted by the Maine Waste Management Agency. The WMH sets the priorities for managing waste. It calls for:

1. Source Reduction
2. Reuse
3. Recycling
4. Composting
5. Incineration and Waste-to-Energy
6. Land Disposal

Source reduction is the highest priority of the WMH. By emphasizing reduction and reuse we can move closer to a sustainable future by preventing pollution and protecting natural resources. By taking recyclables to a collection center, and buying products made from recycled materials we are "closing the loop" to further reduce waste. In making choices about products we buy and things we do, we should aim to be as high on the hierarchy as we can!

More information about the activity materials is included in the section Additional Information for the "Expert."

Planning Considerations

1. Gather the items ahead of time, using as many as possible from around the school or from students. Substitute items if necessary.
2. Decide which of the two activity formats to use with the class.

   Discussion Format: Small groups of students analyze the products in each step and help with discussion. For each step of the activity choose an appropriate number students to analyze the items. Have them do the task and answer the questions. The whole class should be encouraged to participate with the volunteers in the discussion. Have the class answer the question about the Waste Management Hierarchy.

   Game Format: Select a panel of judges and divide the class into two teams. Two players (one from each team) accomplish the *task* cooperatively, then each answers a *question*. The judges may ask the teams to clarify their answers. They award up to ten points to each team for their answer. The teacher (or another "expert" using the notes at the end of this activity) may offer additional information. After the points are awarded, the class should answer the question about the Waste Management Hierarchy.
3. Keep the information at the students' level of understanding. The groups of items begin with easier, more obvious choices and comparisons, then get more difficult. Steps can be eliminated or modified if they are beyond the level of the students.

◆ **Advanced Level Activity:** Steps describing additional hazardous materials are included in the section on "Information for the Expert". If you want to focus on hazardous materials, begin the activity with batteries and continue with glue, furniture polishes, oven cleaners, drain openers, paint, and mothballs.

Procedure

1. List the waste management hierarchy on the board (refer to the WMH during each step.)
2. If you are using the game format, choose judges and divide the teams. Explain the process of performing the task, answering the questions, and awarding points. Begin with the first step.
3. If you are using the discussion format, ask for the first volunteers and have them perform the task for the first step. Have the volunteers answer the questions. Have the class discuss their answers.
4. Continue moving through the steps, encouraging discussion and having students relate choices to the WMH.
5. Conclude the lesson by discussing which of the choices seem to be the most important for protecting the environment. What will you do (or ask your parents to do) differently when you go shopping?

Presentation Steps

1. "Waste" Paper: Describe possible uses for two reusable forms of paper.
   Task: Line up three items in order of reusability - a piece of crumpled paper from the wastebasket, used paper blank on one side, notepads made from that paper.
   Question 1: What are three good ways to use paper that is blank on one side, rather than throwing it away?
   Question 2: Why is reusing the paper better than recycling it? When should it be recycled?
   (How does each way of dealing with used paper fit on the WMH and help provide for a sustainable future?)

2. Lunch Wrappings: Compare throw-away items versus reusable lunch containers.
   Task: Separate the wrappings into two groups: Reusable and disposable.
   Question 1: How could each of the disposable items be reused?
   Question 2: Which is the better way to pack a lunch? Why?
   (How does each type of lunch fit on the WMH and which helps provide for a sustainable future?)

Materials (cont.)

• beverage containers:
fast-food cold cup
small milk carton
aluminum can
glass bottle (refillable)
iced tea concentrate jar
empty glass

• batteries:
disposable (AA, C, or D size with no added cadmium or mercury)
button battery
rechargeable batteries
solar rechargeable batteries
toy not requiring a battery (e.g. Slinky™)

• glue:
white glue (Elmer's Glue-All™)
rubber cement

optional: Hazardous materials (hazmats) two brands of each:
• furniture polish: petroleum based, lemon oil polish
• oven cleaners: corrosive type, fume-free oven cleaner
• drain opener: any two brands
• paint: oil-based paint and latex paint
• moth balls
• alternative products spray bottle
vinegar
baking soda
Murphy's Oil Soap™

Everyday Choices for a Sustainable Future

3. Shopping Bags: Compare paper, plastic, and fabric bags
   Task: Line up the three bags from the "best" to the "worst."
   Question 1: What does the bagger ask you at the check-out line at your grocery store? How do you usually answer? Why?
   Question 2: Which type of bag is the best for the environment? Why?
   (How does each bag fit on the WMH and which helps most to provide for a sustainable future?)

4. Beverages containers: Compare fast-food cold cup, small milk carton, aluminum can, refillable glass bottle, jar from iced tea concentrate, empty glass.
   Task: Arrange items in order from the largest amount of waste produced to the one generating the least waste.
   Question 1: Why did you arrange the items this way?
   Question 2: Is it better to recycle or refill the glass bottle? Why?
   (How does each container fit on the WMH and which help the most to provide for a sustainable future?)

5. Detergent: Compare regular and concentrated detergents.
   Task: Decide which detergent is less harmful to the environment.
   Question 1: How does the concentrated detergent reduce waste?
   Question 2: How might the concentrated detergent be more harmful or dangerous?
   (Where does each detergent fit on the WMH and which helps more to provide for a sustainable future?)

6. Batteries: Compare disposable, button, rechargeable, and solar rechargeable batteries. Look at a non-electric toy and discuss the alternatives to dependence on battery powered toys.
   Task: Arrange the items according to the amount of waste they produce *and* the amount of energy used.
   Question 1: How are disposable batteries harmful to the environment?
   Question 2: How would your life be different if you used no disposable batteries? No batteries at all?
   (Where does each product fit on the WMH and which help the most to provide for a sustainable future?)

7. Glue: Compare rubber cement and Elmer's Glue-All™.
   Task: Decide which type of glue is least harmful to people and to the environment.
   Question 1: Which glue is better to use? Why?
   Question 2: What are the dangers in rubber cement? What are the signal words on the label?
   (Where does each type of glue fit on the WMH and which helps more to provide for a sustainable future?)

8. Optional demonstrations can look at Furniture Polish, Oven Cleaners, Drain Openers, Paint, Mothballs, and Looking at Labels.
   See discussion in Additional Information for the "Expert" below

Additional Information for the "Expert"

Waste Paper

Paper used on one side can be discarded, recycled, or reused.

By using the other side of the paper less waste is produced in the first place even before thinking about recycling.

Notepads are made by cutting up the paper, applying glue at one end and then allowing it to dry.

Lunch Wrappings

The paper bag does not have to be discarded, it *could* be reused even if it usually is not.

It takes soap and water to wash the plastic items and some day the plastic items will be thrown away.

The fabric bag may need to be washed from time to time. (The choice is not all one-sided.)

Shopping Bags

Brown paper bags can be recycled (usually processed and recycled with cardboard.) They can also be reused. If treated carefully, they can be reused many times.

Some people use the paper bags to package other recyclables.

Plastic bags can also be reused or recycled as well as thrown out, but the functional "life" of a plastic bag is shorter.

Fabric bags cost money to buy or make, are not waterproof, and need to be washed. They are much more durable.

Beverage Containers

Fast-food cold-drink cup is paper coated with plastic. It is a single-use item.

Milk carton is paper coated with plastic. Although the carton usually is discarded, it *could* be recycled.

Recycling aluminum creates less waste than manufacturing aluminum from raw materials. It takes 90% less energy to recycle aluminum than to mine bauxite and manufacture new cans.

A little-known point: the colorful printing on the can must be removed before the can is recycled; to do this, the cans must be processed at high temperatures — this, of course, uses energy.

Recycling glass containers takes less energy than manufacturing new ones. Saving raw materials is not as important as it is with aluminum (the silicon and oxygen oxides used to make glass are *very* abundant in the earth's crust.)

It takes less energy to refill a bottle than to make new glass bottles. Refilling glass bottles is feasible for *local* markets — if you have to transport the heavy glass bottles very far, more energy is used in transporting them than is saved by refilling them. Today, most bottling concerns are located far from markets.

Beverage concentrates require less packaging — so they create less packaging waste — and so they use fewer resources; they also use less energy per serving for transportation.

It takes energy to *dry* the beverage powder, so we cannot say — without more information — that using a concentrate is necessarily better for the environment as a whole. *Frozen* concentrate is probably not better for the environment. Because of the energy used in refrigeration, it is doubtful that frozen concentrated beverages represent a move toward pollution prevention.

The average American drinks more beverages in containers than water from the tap.

Detergents

Americans represent only 6% of the world's population, but they use 50% of the world's industrial raw materials. Detergents (laundry detergents, dish washing detergents, shampoo) are one example of how we overconsume: Americans use half of the world's supply of detergent.

More of the material in a box of concentrated detergent is "detergent" and less is "filler."

The down-side to concentrating a detergent: Detergents are the most common source of poisoning in young children. Toxicity is related to dose — the higher the dose, the greater the adverse effect. If the detergent is more toxic than the filler used, a child ingesting the concentrated detergent may receive a higher dose of the more toxic substance.

Batteries

Americans throw away 2.7 billion batteries a year.

It takes about fifty times as much energy to produce the battery as the battery itself produces when you use it — a 2% efficiency in energy use. Compare this to the energy efficiency of an internal combustion engine (about 20%), or the efficiency of an electric power plant (about 40%).

Throwaway batteries are also sometimes a source of heavy metals in landfills (and groundwater) or incinerators (in the ash or in smoke.) Mercury, cadmium and lead are examples of heavy metals. Heavy metals are toxic (sometimes in very low doses) to plants, animals and humans exposed to them. Battery manufacturers are working to reduce the amount of mercury in batteries.

It is not profitable to recycle these batteries today, so they are thrown away. In addition to wasting energy, we waste the

Everyday Choices for a Sustainable Future

Related Activities

- *Getting to the Route of the Hazardous Waste Problem*
- *Test the Alternatives*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Home Household Hazardous Waste Audit*

resources used to produce these batteries. (However, there is an international effort to look for ways to make battery recycling profitable.)

The label on some disposable batteries says *Safer for the environment* because no mercury or cadmium have been added when manufacturing them. This is helpful, but the batteries still waste energy and resources.

Button batteries contain up to 40% by weight mercury or silver — so they are valuable and *can be* recycled. When button batteries are thrown in the trash, they are often burned in an incinerator. Since mercury is volatile (easily evaporated), it can get into the air. From the air, it settles onto water and land. Mercury is a heavy metal and certain forms can be toxic even at low doses.

Rechargeable batteries use fewer resources because they can be used many times. Using them is better for the environment. It takes electrical energy to recharge them, but much less energy than it takes to manufacture new ones.

Solar rechargeable batteries are really much better for the environment because the sun's energy is used to recharge the batteries and they can be reused many times. Unfortunately, they may take many hours of sunlight to recharge — we expect that there will be future improvements in solar batteries.

Slinky™: Non-electric toys reduce waste and protect the environment by avoiding batteries in the first place (source reduction.)

Reducing Use of Toxics

One way of practicing pollution prevention is to lower our exposure to toxic substances.

White glue and rubber cement

The label on rubber cement says "danger, extremely flammable."

The glue-all label says "safe, no harmful fumes."

For some uses, the white glue works as well as rubber cement — when this is true, which product would you use?

Flammable usually indicates a material that catches fire more easily than a combustible one, but both need to be treated with care.

Using the Glue-All™ is a type of pollution prevention called *toxics use reduction* — you are lowering your exposure to a toxic substance.

Furniture polish

The label on a petroleum-based brand says "danger, extremely flammable."

The lemon oil polish is "non-toxic, non-combustible."

A third, and inexpensive, choice is homemade polish. Mix vegetable oil with a little lemon juice — this is cheap and non-toxic.

Oven cleaners

The label on the corrosive oven cleaner reads, "Danger: may cause burns to skin and eyes, contents under pressure. Harmful if swallowed. Read cautionary labeling on back panel."

The other oven cleaner reads, "Fume free, non-caustic formula cleans without lye."

How else might you take care of your oven that could avoid the use of either product?

What can you do to keep your oven from having to be cleaned as often?

Drain openers

The label on one can of drain opener may read, "DANGER: keep out of reach of children. Can cause burns on contact. Harmful if swallowed. Read back label carefully."

Another can may say, "Poison, Harmful or fatal if swallowed or misused. Causes severe burns to eyes and skin on contact. Keep out of reach of children. Read precautions on back panels carefully."

Do *either* of these *caustic corrosive* products sound safe to use? Are there other ways to keep drains clean?

Use preventive maintenance. For example, your parent can carefully pour boiling water down the drain once a week, sometimes with baking soda. If the drain becomes stopped up anyway, try using a plunger to open it up. Or, if you have a mechanical snake, use it.)

In the U.S., drain openers are responsible for more than 2,000 visits per year to hospital emergency rooms.

Paint

Discuss the differences between oil-based paint and water-based (latex) paint. The oil-based paint leads to more indoor air pollution than with the water-based paint; it is more flammable, and usually it is more toxic.

Moth balls

Why are moth balls used?

What problems could there be with the use of moth balls? (e.g. indoor air pollution, a small child swallowing the moth balls).

Moths are attracted to stains on a fabric — fabrics put away clean do not attract moths.

Ask students to mention other products around the home that may be of concern and discuss these.

Looking at Labels

Signal words: Look for the word *poison* or *danger* on the label. Danger and poison are signal words indicating an especially toxic or otherwise dangerous substance.

For *pesticides*, the signal word warning refers to intermediate toxicity and caution to the lowest toxicity.

For *chemical products* other than pesticides, warning or caution do not have as precise a meaning as for pesticides, although caution usually refers to a lower degree of hazard.

The word caution really does indicate a *need* for caution. Many accidents occur with products with a simple caution on the label. For example, detergents are a very common cause of poisoning in small children.

" Non-toxic" has no legal meaning — any substance can be toxic in high enough doses. However, if a product ingredient meets the legal definition of hazard, it must have a signal word on the label, so 'non-toxic' may be assumed at least to be *less* toxic.

Signal words refer to the *acute* toxicity of the substance — an adverse health effect that occurs soon after exposure. Signal words may not be useful when thinking about long-term exposure to a substance — *chronic* toxicity. This is another reason to use *all* products with care.

Discussion Questions

1. Who is responsible for producing waste?
   Discussion
   We are all responsible — industry and other businesses, our towns, *and you and I*. Our consumption habits lead industry to produce ever larger quantities of consumer products which leads to:
   - Depletion of resources;
   - Pollution as these products are produced;
   - Pollution as they are used, recycled, or thrown away to landfill or incinerator.
2. Why is it important to stay near the top of the Waste Management Hierarchy?
   Discussion
   The higher we stay, we will produce less waste, less pollution. Source reduction is also called Pollution Prevention (P2). Examples are
   - Increased efficiency in using raw materials, energy, water and other resources — conservation;
   - Using fewer hazardous substances;
   - Purchasing fewer consumer goods or consumer goods with less packaging.
3. Why is it better to reduce and reuse than it is to recycle?
4. What habits do you think you (or your family) will be able to change when you shop?
5. How can you help other people understand why it is important to make different decisions?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *Classroom and Office Paper Reuse Campaign*
- *"Buy Recycled" Campaign*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Adapted and rewritten from the activity "Moving Toward Pollution Prevention" developed by Dr. Marquita Hill, and funded by a grant from the U.S. EPA to the Chemicals in the Environment Information Center at the University of Maine, 105 Jenness Hall, Orono, Maine 04469 (207) 581-2301.

Can I Make a Difference?

For Better or Worse

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials

boxes or packages from home that demonstrate both wasteful and low-impact packaging

- multi-layered, difficult-to-recycle packaging
- single serving items
- "natural" packages (apple, peanuts)
- concentrated products and lightweighted packaging (laundry detergent)
- packaging from renewable resources (paper)
- packaging from recyclable resources (glass bottle, aluminum can, steel can)
- similar products in "better" and "worse" packaging.
- recycled content packaging

Related Activities

- *Source Reduction/ Recycling Quiz - Consumer Survey*

Key Question
How can I make good decisions about packaging I buy in the store?

Overview

Given a variety of empty packages, students arrange them in order from "better" to "worse" considering the environmental impact of the packaging material. A small group discusses the items to reach consensus about the sequence. In the process they learn about the qualities of efficient, low-impact packaging as well as how to recognize excessive, wasteful packaging. They also evaluate their family's and their own purchasing decisions. Students can provide materials by bringing a variety of clean, empty packaging from home.

Objectives

Students will compare the packages of consumer items; they will evaluate the environmental impact of packaging and propose actions they can take to reduce excess packaging.

Background Information

Packaging serves many functions: to provide protection of a product from damage, to preserve freshness, to provide security from tampering, to prevent theft, to help advertise and for consumer convenience. Packaging and advertising certainly influence what people buy. Although we have many options in the marketplace, many of us pay extra for convenience that we don't really need. Efforts are being made by many manufacturers to provide packaging that is less wasteful, both in terms of the energy and natural resources used in manufacturing and in the contribution to the waste stream. One way to reduce the amount of waste we generate is by making thoughtful choices when we buy packaged products. Look for the manufacturer's environmental statement on the label. Be objective, however, about the information provided and evaluate the information. Gray-colored paperboard (the type used in many cereal boxes) is usually made from recycled paper.

Packaging is one of the many things we think about when deciding to buy a particular product. There are many different perspectives when you consider packaging: How safe is it? How strong is it? How expensive is it? How well does it serve its purpose? Another important perspective asks, How environmentally sound is it? The goal of this activity is to have students look at packaging from the perspective of its environmental impact.

Packaging can be evaluated for environmental impact by considering:

- How renewable are the resources the packaging is made from?
- How easy is it to recycle the packaging?
- Is the packaging made with recycled materials?
- Is the packaging made from multiple layers (paper, plastic, metal, etc.) which are particularly difficult to recycle?

- Has the packaging been designed to use less material ("lightweighted")?
- Does it contain a concentrated product so less packaging is needed per unit of product?
- Does it contain a hazardous product which might contaminate the package and make it difficult to dispose of the package safely?
- Does it contain small individually wrapped units?
- Could it be sold in bulk, eliminating the need for manufactured packaging?

Management Suggestions

1. The first part of the activity helps prepare students with information about the environmental impact of different types of packaging.
2. The second part gives students the opportunity to use this information to evaluate a large group of packages and make decisions.
3. Encourage students to be objective about their items. They should discuss how the items compare, and they should discuss the aspects of their items and agree where they fit in the line. If there are arguments the teacher can use the opportunity to help look objectively and resolve the differences with help of the group.
4. *Students should consider the packaging* ***only,*** *not the contents.* This is difficult, but if they think of the contents of all the packages as the same product, for example, raisins, it is easier to make consistent judgments.

Procedure

Part 1

1. Place four items on a table in front of the class. Make the selection as diverse as possible. Have two students arrange the items from environmentally "best" to "worst" on the basis of packaging. Have the students line the items up, discussing among themselves as they go along.
2. Discuss their decisions using the categories listed in the Background Information.

Part 2

3. Have each student choose an item as "their own."
4. Students then must decide if their item is "better" or "worse" than the others and get into their place in line. Students should discuss *and agree* that each person is in the best place in the line.
5. When the line is settled, have each student give one observation about the package that helped her or him decide this was the best spot in line.

Discussion Questions

1. What was environmentally "better" about some items and "worse" about others?
2. In choosing products and packaging, do all people have the same likes and dislikes, the same needs?
3. How could some of the "worse" items be redesigned to be made "better"?
4. When would you choose not to buy a product because of the packaging?
5. What other things could we consider when choosing "good" and "bad" packaging?
6. What steps can you take to encourage manufacturers to limit excess packaging or inform consumers not to buy products with excessive packaging?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *Trash-to-Art Festival*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*

Adapted from an activity (adapted from CONEG) by Gayle Briggs, planner for the Maine Waste Management Agency Office of Waste Reduction and Recycling.

Can I Make a Difference?

Are Ten Better Than One?

Level

- **Introductory**
- **Intermediate**

Materials

unopened boxes of cereal:
1 variety pack of individual boxes
1 large box

containers to store the cereal

measuring cups to measure the volume of cereal

tape

measuring stick

chart paper to record measurements

Related Activities

- *Source Reduction/ Recycling Quiz - Consumer Survey*

Key Question

How does the size of a package affect how much packaging is used and how much waste is produced?

Overview

Students disassemble the packaging from both a 10-pack of individual cereal boxes and a single large size cereal box. They tape the inner and outer layers together so they can measure the area of material each package contains. They can easily compare the inefficiency of single serving packages to the efficient larger size.

Objectives

Students will compare the amount of packaging required for single serving boxes with packaging from a single larger box. They will relate this to the amount of waste generated and their own role in reducing waste.

Background Information

Packaging is used to keep food products fresh and to help sell the product by appealing to the consumer. "Convenience foods" are designed to make shopping and preparation easier for consumers. The cost of packaging is a large part of the cost of many food items. Research shows that one dollar out of $11 spent on food pays for packaging. In addition, most packaging must be discarded or recycled when the product is used up. In smaller sizes the percentage of packaging is larger.

Consumers decide to buy any particular product for many individual reasons. As students become aware of the inefficiency, expense, and disposal problems associated with individual packaging, they (and their families) can make more informed choices in the marketplace.

Management Suggestions

1. Keep the cereal product clean so it can be eaten after the lesson is completed.
2. Students may work in teams to prepare the packaging and make measurements.
3. At the end of this activity, display the completed package strips, chart paper, and calculations on a bulletin board.

Procedure

1. Look at the two unopened cereal packages and have students estimate the number of servings in each. Define net weight and compare weights on the packages. Have a student read the number of servings per package on the label and compare to the estimates made.
2. Ask students which package they think has more packaging.
3. Carefully remove the outer wrap from the variety pack, open up and flatten the cellophane to demonstrate how the rest of the packaging will be opened up.
4. Pass out the boxes of cereal to students. Have them open the boxes and put cereal into the proper container.
5. Have the students separate the inner lining from the box and flatten the materials.
6. Help the students tape the various components of each package together into one strip for the variety pack, and another strip for the large box. Try to arrange the pieces so they have similar width.
7. Hold the two strips up to compare the length of each with the volume of cereal that each package held.
8. Data and Analysis
   - **Introductory:** Measure the length and width of each strip.
   - **Intermediate:** Calculate the surface area of packaging in each package. Calculate the amount of packaging per unit of product; cost of the packaging per unit.

Discussion Questions

1. Which of the packages had more cereal? Which had more packaging?
2. Why do smaller packages have more packaging material per serving?
3. How is the packaging disposed of when the cereal is gone? What is the effect of individual packaging on the waste stream?
4. What other products come in individual packages?
5. Why do people buy things in individual packages? When might it be necessary? When might it be unnecessary?
6. How can the amount of waste from packaging be reduced?
7. What can you do to help reduce the waste stream?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *Trash-to-Art Festival*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*

Can I Make a Difference?

Paper, Plastic, or Cloth?

Level

Intermediate

Materials

samples of each type of shopping bag: paper, plastic, cloth

three "bag type" cards for each group of players

one set of cards for each group of players (cut apart the cards provided and reuse paperboard for a backing

score paper

Related Activities

- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*

Key Question

When we go shopping what kind of bag is best?

Overview

This activity is a card game in which each player represents a type of shopping bag: paper, plastic, or cloth. Each card has a statement about a characteristic of the different bags and point value, either positive or negative. If the statement applies to the bag the player represents, the points are added (or subtracted) to the total score. Although the cloth bag is favored to win, this is not guaranteed. Students discover the trade-offs between the different bag choices and that environmental choices are rarely black and white.

Objectives

Students will compare the benefits and liabilities of paper, plastic, and reusable cloth grocery bags; they will judge environmental decisions and recognize that they are rarely clearly right or wrong.

Background Information

At the supermarket checkout counter, the clerk usually asks if we want a paper or plastic bag. Most environmentally concerned shoppers ask for a paper bag because they know paper is made from trees, a renewable resource. Plastic is not biodegradable and is made from nonrenewable oil.

But this is not such a simple issue! Brown paper bags are made mostly from new pulp (on average, paper bags contain only 6% recycled fiber.) Trees are often grown in heavily fertilized plantations or clear cut from wild forests. The paper-making process adds to water pollution and acid rain. Paper and plastic bags both are usually landfilled or incinerated. Plastic shopping bags are usually made from non-renewable low density polyethylene (LDPE - #4) which actually may be less damaging than paper is to the environment because they use much less raw material in manufacture, are lighter, and take less space in landfills. Cloth shopping bags have obvious advantages because they are reusable, washable, and are made from renewable resources, but they also have disadvantages in that they are more expensive to buy, are not waterproof and are less convenient.

The Game

Paper, Plastic, or Cloth? is a card game for three players, or three teams of two or more. Each player or team represents a paper bag, plastic bag, or reusable cloth bag. The game begins by choosing a "bag type" card to determine which bag each player or team represents. Playing cards are dealt face down.

For each round, players flip the cards up simultaneously as in the game of Slap Jack. If the point values of any two cards are the same, the player who slaps the opponent's card that matches his or her own point value claims both cards.

Players then read the statements on the cards. If the statement applies to the player's "bag type," the points are added to or subtracted from the team score. Discussion can help resolve differences of opinion and the chart below might help mediate.

The game continues until one team reaches 50 points or all the cards are played. Following the law of averages, the cloth bag

Card Topics

Characteristic	# cards	Points	Paper	Plastic	Cloth
Made from trees - mostly new pulp	1	-5	x		
Made from unbleached paper pulp	1	+5	x		
Paper-making produces water pollution	1	-10	x		
Paper-making adds to acid rain	1	-10	x		
Made from a renewable resource	3	+10	x		x
Biodegradable	2	+15	x		x
Burns relatively clean when incinerated (when burned, both unbleached paper and polyethylene produce fewer emissions than bleached paper)	2	+5	x	x	
Easily recycled with cardboard	1	+5	x		
Not waterproof	2	-5	x		x
Double bags often needed for strength	1	-5	x		
Can be reused more than once	3	+5	x	x	x
Can be used for more than a grocery bag	3	+5	x	x	x
Paper bags rip if filled too full	1	-5	x		
Not biodegradable	2	-10		x	
Made from non-renewable resources	1	-10		x	
Plastic bags dyed red and yellow can contain heavy metals which can pollute	1	-10		x	
Can be hazardous to ocean animals	1	-10		x	
The bag most difficult to recycle	1	-5		x	
Can contain vapors which can get into food and be harmful	1	-5		x	
Convenient - don't need to take it with you to the store	2	+5	x	x	
Waterproof	1	+5		x	
Often has handles and is easy to carry	2	+5		x	x
Can get holes easily which makes it unusable for many trips	2	-5	x	x	
Can be reused hundreds of times	2	+20			x
Lightweight	3	+5	x	x	x
Less convenient - you have to take it with you to the store	1	-5			x
Most expensive - you have to buy it or make it	1	-5			x
Can be washed and reused	1	+5		x	x
Strongest type of bag	1	+10			x

should win this game, yet any of the bags could win, depending on skill and luck. Students will conclude that there are trade-offs for each type of bag.

Preparation

1. Prepare a set of playing cards for each group. Cut out the statements and glue them on card-sized tag board for durability. Mark the "bag type" cards so they are kept separate from the playing cards.
2. Review the concepts on the cards so students are familiar with the words and facts.
3. If this game is played in teams, have one individual from each team play a round. Rotate team members after each round.

Rules for playing the game

1. Each team (or player) chooses one of the "bag type" cards to determine which type of bag the team represents.
2. Deal all the cards out to the three teams, face down. Each team (or player) should have an equal number of cards.
3. On a signal (the players can count out 1-2-3-go) the three players flip their cards simultaneously.

Paper, Plastic, or Cloth?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*

4. If two players turn up cards with matching point values, the player who slaps the opponent's matching card before having his or her card slapped, claims both cards as his or her own. (Players should be careful of slapping cards with negative point values!)
5. The player with the highest point value begins the game.
6. The player reads the card aloud and says whether the statement on the card applies to the team's "bag type." If the statement applies, the points are awarded to the team (either positive or negative.) If the statement does not apply, no points are awarded. (e.g. If the "paper bag" team has a card that says "Biodegradable," they are awarded the 15 points assigned to the card; if the "plastic bag" team gets "Biodegradable," they receive no points for that card.)
7. The other two players read their cards and record their score to complete the round.
8. Repeat the procedure for the next round, keeping track of the score. If teams are used, rotate players for each round.
9. The winner is the first team (or player)to reach 50 points or the team with the most points when all the cards have been read.

Discussion Questions

1. Which bag won? Is it the best to use?
2. Are there times when one bag is better than another?
3. Why isn't it a clear choice?
4. Which cards were the most important in the game? Why?
5. What advice should you give your family about bags when you go shopping?

Score Sheet: Paper, Plastic, or Cloth?

Use one space to tally the scores in each round. Add or subtract the score.

Round	Paper Bag Team	Plastic Bag Team	Cloth Bag Team
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
Total			

Bag Type **Paper Bag**	Bag Type **Reusable Cloth Bag**
Bag Type **Plastic Bag**	**-5** Made from trees - mostly new pulp
+5 Made from unbleached paper pulp	**+10** Made from a renewable resource
+10 Made from a renewable resource	**-10** Paper-making produces water pollution

+10 **Made from a renewable resource**	**+15** **Biodegradable**
-10 **Paper-making adds to acid rain**	**+ 5** **Can be reused more than once**
+ 15 **Biodegradable**	**+ 5** **Can be reused more than once**
+ 5 **Burns relatively clean when incinerated when burned, both unbleached paper and polyethylene produce fewer emissions than bleached paper**	**+ 5** **Burns relatively clean when incinerated when burned, both unbleached paper and polyethylene produce fewer emissions than bleached paper**

+ 5 **Can be reused more than once**	**+ 5** **Can be used for more than a grocery bag**
+ 5 **Easily recycled with cardboard**	**+ 5** **Can be used for more than a grocery bag**
- 5 **Not waterproof**	**+ 5** **Can be used for more than a grocery bag**
- 5 **Not waterproof**	**- 5** **Double bags often needed for strength**

- 5 **Paper bags rip if filled too full**	**- 10** **Not biodegradable**
+ 5 **Convenient - don't need to take it with you to the store**	**+ 5** **Convenient - don't need to take it with you to the store**
- 10 **Not biodegradable**	**-10** **Made from non-renewable resources**
+ 5 **Waterproof**	**+ 5** **Often has handles and is easy to carry**

- 10 Plastic bags dyed red and yellow can contain heavy metals which can pollute	**- 10** Can be hazardous to ocean animals
+ 5 Often has handles and is easy to carry	**- 5** Can get holes easily which makes it unusable for many trips
- 5 Difficult to recycle	**- 5** Can contain vapors which can get into food and be harmful
- 5 Can get holes easily which makes it unusable for many trips	**- 5** Less convenient - you have to take it with you to the store

+20 **Can be reused hundreds of times**	**+20** **Can be reused hundreds of times**
- 5 **Most expensive - you have to buy it or make it**	**+5** **Lightweight**
+ 5 **Can be washed and reused**	**+10** **Strongest type of bag**
+5 **Lightweight**	**+5** **Lightweight**

Where'd You Get That Can?

Key Question
Why is recycling aluminum more efficient than making aluminum cans from raw materials?

Level
■ Intermediate

Materials
- 2 large buckets
- 5 heavy bags (about 10 pounds of sand or a half cement block in each grain bag is ideal)
- 10 bricks
- 5 balls of crumpled newspaper covered with aluminum foil (about the size of a soccer ball)
- 10 wooden blocks covered with aluminum foil (8 inch sections of 2x4 are ideal)
- 50 aluminum cans (in 2 boxes of 25 cans each)
- 25 crushed cans in a box
- signs identifying each station
- 8 boxes

Related Activities
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview
This is a relay race for two teams using a large space (like the area of a basketball court) either indoors or outdoors. One team follows the course of aluminum cans manufactured from bauxite ore and the other follows the course of recycled cans. The materials and distances in each course correspond to the real manufacturing processes. Students learn that it takes much more energy to make aluminum from raw materials than it does to recycle. Depending on how the course is set up, however, the times can be close; there is no guaranteed winner.

Objectives
Students will compare the energy (effort) it takes to produce goods from raw materials and from recycled materials; they will evaluate the importance of reducing and reusing before recycling.

Background Information
Aluminum is the third most common element on the earth's surface, yet processing aluminum from the earth into useful products is very difficult. Mining aluminum ore (bauxite) and refining the aluminum demands vast amounts of energy and is very polluting. High grade bauxite, which contains about 45% aluminum oxide, is blasted and dug from the earth, then transported to a processing plant. There it is crushed, washed, dried and transported to a refining plant. The powdered ore is dissolved chemically then dried again to produce alumina (a compound of aluminum and oxygen) and transported to a smelting plant. In the smelting process, alumina is melted, combined with carbon rods and charged with a powerful electric current (750 volts), which produces equal amounts of pure aluminum and carbon dioxide. The molten aluminum is then formed into ingots which can be molded into various products. It takes about 4 pounds of high grade bauxite ore to produce one pound of aluminum. One pound of aluminum makes 25-30 soft drink cans.

To recycle aluminum, used aluminum cans or aluminum scrap materials are collected, shredded, re-melted and formed into ingots which can be molded into various products. About 95% less energy (mostly electricity) is used to recycle aluminum than to produce aluminum from bauxite ore. In addition, recycling aluminum creates 95% less air pollution and 97% less water pollution. It takes 1.25 pounds of scrap aluminum to make one pound of reprocessed aluminum. It can take as little as six weeks from the time a can is purchased in the store until it is remanufactured and back on the store shelves. In 1991 62.4 % of aluminum beverage cans were recycled in the U.S.

Can I Make a Difference?

Where'd You Get That Can?

Related Pathways to Action Projects

- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*

Management Suggestions

1. This is a relay race which demonstrates the relative amounts of energy used in producing aluminum cans from raw materials and from recycling. Do this activity in the gym, hallway or outside; it is a noisy activity and requires a minimum course length of 60 feet.
2. The materials for this activity are bulky and some are heavy. Students can help gather the materials needed for the activity in the days before the race.
3. Time each team and keep a record of each round.
4. Plan to award prizes to the winners.
5. When finished be sure all materials are reused or recycled!

Relay Race Description

1. Two teams run separate courses which symbolize
   - Mined Aluminum Manufacturing Process
   - Recycled Aluminum Manufacturing Process
2. Each course has six stations, shown in the charts.
3. Players carry a bucket from station to station trading the materials from the previous station to the more "processed" materials at the next.
4. A player finishes the manufacturing process by delivering five "finished" cans to the Soft Drink Bottling Plant, then runs back to Start and hands the bucket to the next player in line.

Procedure

1. Set up the six stations in each Process with materials outlined in the carts.
2. Choose two teams of five or more students each for each round of the relay race.
3. Identify each station and what each of the materials represents.
4. Review the rules of the race.
5. Line up the players for each process and give the signal to start.
6. Continue until all players have delivered their cans to their Bottling Plant.
7. Compare the time (and energy) difference between producing cans from raw materials and from recycled cans.
8. Repeat rounds for other students in the class to participate.

Discussion Questions

1. Did the race turn out like you expected it to? How did your race compare to the time and energy of the real manufacturing process?
2. Why does it take more time and effort to manufacture cans from bauxite than from recycled aluminum?
3. What natural resources are saved when aluminum is recycled? Consider raw materials, transportation, manufacturing.
4. What natural resources are saved by recycling paper; glass; steel cans; plastic?
5. Considering how effective it seems to recycle, why is it better to reduce and reuse before recycling?

Mined Aluminum Manufacturing Process

The "optional detours" make the Mined Aluminum Manufacturing Process longer and more representative of the greater amount of energy needed than in the Recycled Aluminum Manufacturing Process.

Station	Distance from Last Station	Materials at Station	Process
1. Start	0		At the Start signal, run to Bauxite Mine.
2. Bauxite Mine	10 feet (may include optional detour)	5 bags of sand or cement block (one for each player); each bag also has 2 bricks	Place bag of sand in bucket and run to Refining Plant. OPTIONAL DETOUR: Carry the bag around a marker 10 feet from the Bauxite Mine and 10 feet back to the Refining Plant.
3. Refining Plant	10 feet (may include optional detour)		Remove the 2 bricks from the bag and put them into the bucket, run to Smelter. OPTIONAL DETOUR: Carry the bucket with bricks around a marker 10 feet from the Refining Plant and 10 feet back to the Smelter.
4. Smelter	10 feet	5 ingots (1 for each player); box for bricks	Remove the bricks, put them in the box and place one ingot in the bucket, run to Can Plant.
5. Can Plant	10 feet	25 cans (5 for each player); box for the ingots	Remove the ingot and put it into the box, count out 5 cans into the bucket, run to Bottling Plant.
6. Bottling Plant	10-20 feet	box for cans	Remove the cans and put them into the box, run to Start, tag next player.

Recycled Aluminum Manufacturing Process

Station	Distance from Last Station	Materials at Station	Process
1. Start	0		At the Start signal, run to Recycling Center.
2. Recycling Center	10 feet	25 crushed cans in a box (5 for each player)	Place 5 cans in the bucket, run to Recycling Plant A.
3. Recycling Plant A	10 feet	5 aluminum covered balls; box for the crushed cans	Remove crushed cans and put them in the box, put one ball in the bucket, run to Recycling Plant B.
4. Recycling Plant B	10 feet	5 ingots (1 for each player), box for aluminum covered balls	Put the ball in the box and put an ingot in the bucket, run to Can Plant.
5. Can Plant	10 feet	25 cans (5 for each player); box for the ingots	Remove the ingot and put it into the box, count out 5 cans into the bucket, run to Bottling Plant.
6. Bottling Plant	10-20 feet	box for cans	Remove the cans and put them into the box, run to Start, tag next player.

Can I Make a Difference?

Test the Alternatives

Level

- Introductory
- Intermediate

Materials

vinegar
salt
lemon juice
baking soda
vegetable oil
bucket
measuring cups
spray bottle
newspaper
sponges
rags
water
6" x 8" index cards
samples of commercial cleaning products

Related Activities

- *Getting to the Route of the Hazardous Waste Problem*
- *Everyday Choices for a Sustainable Future*
- *School Hazardous Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Key Question

How can we reduce the use of hazardous cleaning products at school and at home?

Overview

Students use recipes to mix nontoxic cleaning products that can be used around the home and school. Then they perform cleaning experiments to test the effectiveness of the cleaners on windows, desks, wooden furniture, and other surfaces.

Objectives

Students will identify the relative dangers of using common cleaning products, then test and compare the effectiveness of nontoxic cleaners.

Background Information

Many household products contain ingredients which can be hazardous to people or the environment. These ingredients can be poisonous, flammable, corrosive and/or cause violent chemical reactions. Hazardous products generally fall into five categories: Automotive products, cleaning and polishing materials, paint and related solvents, pesticides, and miscellaneous items (batteries, some cosmetics, shoe polish.) Unwanted portions of these products become household hazardous waste.

As with the management of all waste, the primary goal is to reduce the amount of waste that enters the waste stream, and then to provide for secure disposal. To do this, we all must be aware of which products we use at home and cut down on our reliance on those that contain toxic substances. We also need to dispose of the wastes responsibly.

Advertisers of household cleaners promise that our lives will be easier by using their products. Cleaning products are often time saving, yet they also contain hazardous ingredients. Because they are so common, we often use, store, and dispose of them without considering their dangers.

Cleaning products of greatest concern include: Drain openers/cleaners, furniture polish, rug cleaners, and products containing organic compounds and solvents. Disposal of cleaners is not usually as harmful to the environment as the disposal of paints, batteries, or motor oil since cleaners are usually diluted to safer levels when flushed down the drain. Excessive amounts can be dangerous, however, especially for household septic systems. Consumers often disregard label instructions, do not use adequate ventilation, and don't keep them out of the reach of small children. Aerosol sprays are easily inhaled from the air. The health effects of long term exposure to small amounts of these products are not known, however many do contain carcinogenic compounds.

Homemade cleaners can be made from common, inexpensive, nontoxic materials. They may not be as effective as commercial cleaners, however, since they often require more "elbow grease" and more frequent (preventative) cleaning to work effectively. Yet, in addition to being nontoxic and better for the environment, they cost about half as much as commercial cleaners.

Management Suggestions

1. Remind students of safety concerns: NEVER put cleaning products or the ingredients in the mouth.
2. Keep groups to 3-4 students each. Have several groups make and test the same recipe if necessary.
3. ● **Introductory:** Limit the recipes tested to scouring powder, window cleaner, and furniture polish.
4. ■ ◆ **Intermediate and Advanced:** Have them clean half of the surface with commercial cleaner and the other half with the home made alternative. Keep a chart comparing the cost, effectiveness, and relative harm to the environment for each of the cleaners tested.

Procedure

1. Discuss household cleaning chores and the products used to do the chores. Review the meaning of hazardous products. Discuss the dangers of toxic cleaners: Read the labels for contents, cautions and recommendations for disposal.
2. Display examples of the ingredients of nontoxic cleaning products. Ask students where they have seen baking powder, lemon juice, vegetable oil, and salt. Discuss how these items are commonly used. Compare the dangers of the commercial products and the nontoxic ingredients to people and the environment.
3. Read over the recipes for the alternative cleaning products. Discuss how to follow a recipe. Discuss measuring ingredients accurately.
4. In small groups have students use a recipe to mix a nontoxic cleaner. You may want to assign each group member to a specific task (measurer, tester, result reporter, etc.)
5. Assign a specific cleaning task to each group (washing windows, cleaning desks, polishing wooden furniture.)
6. When the cleaning jobs are finished, have each group report to the class or prepare a written report on how the cleaner worked.
7. ● **Introductory:** Hand out index cards and have students create recipe cards to take home. Younger students could decorate cards made by the teacher.
8. Have students try the alternative cleaning products at home. Interview their families about how the alternative products worked. Did they work as well as products from the store? Does the family agree that the nontoxic products are more healthy for them and for the environment than the toxic ones?

Discussion Questions

1. How can commercial cleaning products be harmful to the environment and people?
2. Why is it better for the earth to use nontoxic cleaning products?
3. Were the alternative cleaning products as effective as commercial products?
4. Do you or your family feel you should use commercial products instead of the nontoxic alternatives? Why? What pressure do you think advertising has on your feelings?
5. What can you do to help other people understand the dangers of toxic products and the advantages of nontoxic alternatives?

Related Pathways to Action Projects

- *Classroom Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Buy Recycled" Campaign*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Adapted from AVR Teaching Toxics (1992)with permission from the Association of Vermont Recyclers, PO Box 1244, Montpelier, VT 05601; (802) 229-1833.

Test the Alternatives

Recipes for Alternative Cleaners

Scouring Powder (for desks, tables, and shelves)

For each desk mix together:
2 Tablespoons baking soda
1 teaspoon salt
Sprinkle on surface, use sponge to clean. Rinse desk with water on a sponge. Baking soda may leave a film so use plenty of water to rinse.

Furniture Polish (for wooden surfaces)

2 cups vegetable oil
1 cup lemon juice
In a container, mix oil and lemon juice together. Apply with a rag.

Window Cleaner

1/4 cup vinegar
4 cups warm water
Mix in a spray bottle. Spray on surface. Use newspaper to dry the glass, this prevents streaking.

a stronger, more smelly window cleaner:
3 Tablespoons ammonia
1 Tablespoon white vinegar
3/4 cup water
Mix in a spray bottle. Spray on surface, wipe with newspaper.

Air Fresheners/Deodorizers

Simmer cinnamon sticks and whole cloves in a small pan of water on top of the stove.

Sprinkle baking soda in odor-producing areas.

Sprinkle baking soda on carpet and vacuum after 30 minutes.

Sprinkle borax in corners of room.

Drain Cleaner

Pour 1/2 cup of baking soda, followed by 1/2 cup of vinegar down the drain. Let stand for 15 minutes, then pour a teakettle of hot water down the drain. For this to be truly effective, you need to clean the drain every couple of weeks.

General Household Cleaners

1. Mix together 1 teaspoon liquid soap (castile peppermint), 1 teaspoon borax, squeeze of lemon juice and 1 quart warm water.
2. Mix together 1/4 cup of baking soda, 1/2 cup of borax, 1/2 cup of vinegar and one gallon of water.
3. For scouring, see Scouring Powder.

Laundry Detergent

Whenever possible, use soap instead of detergents.

To disinfect laundry use washing soda (sodium carbonate) in washer.

Floor Cleaner

Mix together 1/2 cup of white vinegar in a gallon of warm water. Polishing with skim milk after the floor is dry will make the floor glow!

Mildew Remover

Mix together equal parts of vinegar and water in a spray bottle, and use lots of elbow grease! Apply Borax directly to the mildewed area. This task requires maintenance cleaning. Cleaning once a week should keep mildew under control. Always spread your shower curtain out after showering.

Oven Cleaner

Mix together 2 Tablespoons of castile soap, 2 teaspoons Borax and 2 cups water. Apply the mixture and let sit for 20 minutes and scrub. This task requires maintenance cleaning. Add salt to heavy spills and clean immediately to prevent build-up

Leave 1/4 cup ammonia in the oven overnight and wipe away grease the next morning. Ventilate the kitchen and avoid breathing fumes.

Floor Wax

Mix 1 part thick boiled starch an 1 part soap suds. Rub mixture on floor and polish with dry cloth.

Wax Stripper

Pour a little club soda on the area, scrub well, let soak for 5 minutes and wipe.

Rug/Carpet Cleaner

Mix 2 parts cornmeal with 1 part Borax. Sprinkle liberally on carpet, leave on for one hour and vacuum. For stains blot with vinegar in soapy water.

Silver Polish

Put a piece of aluminum foil on the bottom of a pot; add water, 1 teaspoon baking soda, 1 teaspoon salt. Boil silver for 3 minutes, or soak for 10 minutes.

Brass Polish

Polish with Worcestershire sauce.

Copper

Soak in a solution of vinegar and salt

Toilet Bowl Cleaner

For stains make a paste of lemon juice and baking soda, let sit for 20 minutes, scrub with a brush. General: Mix 1/2 cup Borax in one gallon water, scrub.

Other suggestions for cleaners and alternatives to toxic products are available from

Chemicals in the Environment Information Office, University of Maine, 105 Jenness Hall, Orono, ME 04469 (207) 581-3201.

Environmental Hazards Management Institute, PO Box 932, Durham, NH 03824 (603) 868-1496.

Center for Hazardous Materials Research, University of Pittsburgh, 320 William Pitt Way, Pittsburgh, PA 15238 (412) 826-5320.

Self Evaluation

Inventories of waste production at school and at home

These waste inventories and audits help quantify the waste stream in school and in the home. There are many options for simple or detailed inventories, but every audit will help students learn about the types of waste they produce, and present opportunities for reducing that waste. The Waste In Our Community section helps students understand their options for handling trash.

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

School Waste Audit ● ■ ◆ 80

School Hazardous Waste Audit ■ ◆ 84

Source Reduction/Recycling Quiz – Consumer Surveys for Students and Adults ● ■ ◆ 87

Home Waste Audit ● ■ ◆ 92

Home Household Hazardous Waste Audit ■ ◆ 94

Local Waste Management Options ● ■ ◆ 97

Trash Sorting Relay Race ● ■ 100

Self Evaluation

School Waste Audit

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials

bags for collecting and separating trash

scale for weighing bags of trash

rubber gloves and apron for each collector

data record sheets

Key Question
How much trash do we produce in our school?

Overview

This is an inventory of the waste produced in your school. It involves collecting, separating, weighing, and analyzing trash. Forms are included for waste paper, junk mail, food waste and "other" materials. Depending on the group's needs, there are options for limiting the survey to a single classroom or including the entire school. The inventory can help identify priorities for Pathways to Action Projects and it can be used as a baseline for measuring the success of future projects.

Objectives

Students will measure the amount of waste produced in the school. They will determine the contribution each part of the school makes to the waste stream, and then find ways to reduce waste.

Background Information

A waste audit is an inventory of the trash produced in your school, home or business. When students realize how much trash they produce and then they see how much waste other people produce, they become committed to resolving the waste problem. Knowing what you throw away is the first step to reducing waste.

The waste audit is an important opportunity for your students to really get their hands on the waste problem. Even young students can get involved! A simple measure of the trash that is produced in your classroom or what goes into the dumpster in a day will raise the level of concern for both you and your students.

A careful waste audit allows you to gather "baseline data" without influencing the amount of trash that is thrown away. The audit results will accurately measure current patterns, and can be used to analyze improvements after waste reduction programs are in place.

Students can easily measure the amount of trash that they throw away each day in the classroom. As a check to the "big picture" you can weigh all the trash that goes into the school dumpster each day. The students may find that although your room only produces one half pound of trash per person, the school produces three pounds per person as a whole. Where is all the rest of that trash coming from? Are your students also responsible for that?

Planning the School Waste Audit

1. Coordinate the audit with the principal and custodian.
2. Your waste audit can be simple or complex. It is simplest to weigh bags of unseparated trash. Separating and weighing components of the trash provides detailed information, but takes more time. Decide which parts of the school you want to audit, and decide if you want to gather data for a day, two days, a week, or longer.
   - Classroom
   - Classrooms in your grade
   - Cafeteria and kitchen
   - Office, teacher's room, kitchen, bathrooms, other rooms in the school
   - All trash taken to the dumpster
3. If you can't inventory waste from the entire school, plan to audit the areas that produce

the most trash as well as your own classroom first. This will generate enthusiasm for reducing the worst sources of waste.

4. It is helpful to gather the baseline data quickly so you can begin changing behaviors and reducing waste right away. However, the longer the collection period, the more accurate the data.
5. Plan which types of waste you will measure and what you will be able to do with the trash after collecting, separating and weighing. Determine what materials can be recycled in your town (see Local Waste Management Options activity) and separate the trash into the appropriate categories. The Audit Charts are a guide, but you might have other categories that would also be interesting to measure.

Procedure

1. Collecting: Collect waste from various locations for one or two days, or for a week. Set up separate collection bins or boxes for different kinds of waste (paper, food, "other supplies"). This will make separating the trash easier and will help keep the trash cleaner. Using the attached forms, record where the trash came from and how long since the last trash collection. Collect trash from:
   - classrooms
   - "specials" rooms - art, science, music, industrial arts
   - office
   - teacher's room
   - cafeteria
   - kitchen
   - vending machine areas
   - bathrooms
   - custodian's facility
2. Separating and Weighing: Coordinate this activity with the custodial staff. The trash should be weighed as a whole and separated into categories: reusable, recyclable and non-recyclable. Students should work in pairs or in small groups as they separate trash. Reduce possible mess and accidents when separating the wastes by having students wear aprons, rubber gloves, and eye protection. Be particularly careful of dangerous materials like broken glass or household hazardous wastes. Notes should be kept about the trash which reflect the kind of wastes being thrown out, and the wastes that could be eliminated from the waste stream.
   Alternative: A less scientific, but much easier collection strategy is to follow the custodian on the trash pick-up rounds, look at and if possible weigh the trash. Visually estimate the percentage and different types of paper and other items in the trash.
3. Analyzing the Data: Your waste audit will help you determine how big a waste problem you have and the types of waste that are the biggest problem. You can determine which parts of the school are the biggest waste producers.
   a. Analyze the data using the math skills appropriate for your grade level. Graphs are helpful for understanding data like waste production - comparing locations or types of trash. A diagram of the school with waste production figures at various locations would be interesting.
   b. The data from the waste audit can be used to calculate the amount of trash generated annually, or the average amount generated by each individual. Calculate figures for daily/ weekly/ annual waste production and averages for each person/ class/ school. Students can also find percentages of various types of wastes.
4. Using the Waste Audit: The audit numbers will be very meaningful to students. They will probably become angry about the amount of trash they have pawed through and they will have a lot to say about what "people" should do. Channel these emotions by helping students with ideas of what they can do themselves, about the waste they create in their own room, and how they can help others understand the problem. Help them think about the waste they create at home and what their families can do to reduce it. Use the momentum generated from the waste audit to have students decide on action projects which will address the worst waste problems they identified.

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *Classroom and Office Paper Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Waste Paper Audit

The waste paper audit measures the amount of paper that is thrown out. By separating reusable, recyclable and not recyclable paper you can determine the waste paper that can immediately be eliminated from the waste stream. First determine what kind of paper is accepted for recycling in your town.

Collection Date	Location	# People using this site	# Days since last collection	Total Weight	Weight Reusable	Weight Recyclable	Weight Not Recyclable

* *Notes about the non-recyclable materials (over packaged, individually wrapped, disposable items):*

"Junk Mail" Audit

Direct Mail comes into school and our homes daily. In many ways this mail provides access to products and services we need. Often it gets tossed in the trash, unopened. This audit should include only mail which is unwanted and unread. Parents and teachers should all be aware of the collection so desirable mail is not included.

Collection Date	Location	# People using this site	# Days since last collection	Total Weight	Weight of Magazines & Catalogs	Weight of Recyclable Paper	Weight Not Recyclable

* *Notes about "Junk Mail" (which could be discontinued by notifying sender or direct marketing label service!):*

Food Waste Audit

Collect food wastes from classroom snacks and the cafeteria (both cold and hot lunches). Keep these wastes separate from all other collections, and weigh while garbage is still fresh. Estimate the amount that is compostable.

Collection Date	Location	# People using this site	# Days since last collection	Total Weight	Weight Compostable

* *Notes about Food Waste (ideas of ways to reduce waste)*

Waste Audit of "Other Materials"

All "other materials" separated from the waste stream can be weighed and tabulated. Add other categories that apply in your town.

Collection Date	Location	# People using this site	# Days since last collection	Total Weight	Weight Compostable

**Notes about "Other Materials" Waste (household hazardous waste, including batteries; single-use disposable items; items that could be reused; ideas of ways to reduce waste):*

Self Evaluation

School Hazardous Waste Audit

Level
■ Intermediate
◆ Advanced

Materials
variety of hazardous materials found in the school
MSDS sheets for those hazardous products
alternative products chart
audit record sheets

Key Questions
What hazardous wastes do we produce in our school?
What should be done with them?

Overview
This is an inventory of the hazardous waste produced in your school. The inventory involves locating, identifying, and recording hazardous products. Information from the audit can be used in decision-making to reduce hazardous materials and will help the district hazardous materials manager. Students should be familiar with the issues of hazardous wastes before beginning this audit (see the awareness activities: Moving toward Source Reduction, and Pollution Prevention, Getting to the Route of the Household Hazardous Waste Problem, or Test the Alternatives.) Special precautions must be followed to ensure student safety during the audit.

Objectives
Students will list the types and measure the amounts of hazardous materials in the school. They will analyze the role each department in the school plays in the use of household materials, and become motivated to find ways to reduce their use.

Background Information
Production and disposal of hazardous wastes are as much a problem in schools as they are for households. Schools use household and industrial strength cleaners, solvents, polishes, paints, and pesticides which can be hazardous to custodial staff, teachers, and students. These materials must be disposed of properly to avoid contaminating the environment. In addition, schools often stock hazardous chemicals for science, art, or vocational classes.

Schools are required to inventory all hazardous materials and maintain a file of Material Data Safety Sheets (MSDS) for the materials. The inventory and file is usually maintained by the maintenance supervisor for the school or district; the transportation manager sometimes has the responsibility, since the bus garage produces the greatest volume of hazardous wastes. Staff who handle hazardous materials are required by the Occupational Safety and Health Administration (OSHA) and the Maine Dept. of Labor to be trained in the proper use, storage, and disposal of hazardous substances. Unfortunately, this training does not always involve the teachers and principals who order and use many of these materials.

Your school or district may have done a thorough inventory and clean-up of hazardous materials in 1989. The district may also be considered a "small quantity generator" of hazardous wastes and have a contract with a licensed handler to remove hazardous wastes (for products from the transportation garage, for example).

Management Suggestions

1. Introduce the topic of hazardous wastes by doing one of the awareness activities: Moving toward Source Reduction, and Pollution Prevention, Getting to the Route of the Household Hazardous Waste Problem, or Test the Alternatives.
2. Plan the audit with the person responsible for maintaining the school or district hazardous materials inventory and MSDS file. Have that person help introduce the project to students. Do not duplicate the official inventory procedure.
3. Emphasize safety. Careful instruction and supervision for all participating students is critical. Containers should not be opened or shaken.
4. Decide which areas in the school will be included in the audit.
   - classrooms
   - "specials" rooms - art, science, music, industrial arts
   - office
   - teacher's room
   - cafeteria
   - kitchen
   - bathrooms
   - custodian's facility
   - transportation garage
5. Use the audit form from this activity or a form suggested by hazardous materials supervisor (e.g. Chemical Inventory Form used in the state inventory.) A separate list should be made for each room or location. The lists can help make the official inventory more complete.
6. Identify disposal options for hazardous materials in your town, and for your school.
7. Have students work in teams, each supervised by an adult.

Procedure

1. Review the issues surrounding hazardous wastes
   - Many products we use contain hazardous ingredients.
   - Improper disposal can harm the environment.
   - There are limited approved disposal options.
   - Less harmful alternatives to many hazardous products are usually available.
   - We need to reduce production and disposal of hazardous wastes.
2. Brainstorm a list of hazardous products students think are used in the school. Discuss what makes these items hazardous.
3. Show some of the hazardous products from the school and discuss what makes them hazardous, how they should be handled, how they should to be discarded. Refer to the Material Safety Data Sheets.
4. Examine the audit form and discuss the procedures for taking the school hazardous waste audit.
5. Review safety cautions and procedures.
6. Assign areas to be audited. Have teams conduct the audit.
7. When the audit is complete, all information should be provided to the manager of hazardous materials.

Analysis and Discussion

1. Identify the items listed on the audit sheets. Group the items according to what makes them hazardous (e.g. poisonous, flammable, corrosive, reactive.)
2. Discuss students' reactions to the materials they discovered. How hazardous are they?
3. How should different items be treated? Should they be disposed of? How?
4. Do all of these items need to be in the school? What alternative products are available?
5. What can students do to inform others about the dangers of hazardous wastes and the alternatives to using hazardous products?

Related Pathways to Action Projects

- *Classroom Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

School Hazardous Waste Audit

School_____ District_____ Inspected by_____

Room / Location_____ Inspection Date_____

Location	Name of Product or Material	Quantity	Type & Condition of Container	Why is it hazardous? (toxic, flammable, corrosive, reactive)	Comments

Source Reduction/Recycling Quiz

Consumer Surveys for Students and Adults

Key Question
How can we be part of the solution?

Level
● Introductory
■ Intermediate
◆ Advanced

Materials
Copies of the survey form
directions for scoring

Overview
This survey identifies buying habits and personal behaviors that create waste. Students can do the survey in class, and also take a version home for the family to complete. In each case the survey helps everyone to understand ways they can reduce the flow of the waste stream.

Related Pathways to Action Projects
- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Promoting Alternatives to Hazardous Products*

Objectives
Students will analyze their own purchasing and household habits and develop strategies to reduce waste.

Background Information
According to the US Environmental Protection Agency, packaging contributes 33% of the weight and 50% of the volume of municipal solid waste. Disposable ("nondurable") items make up another 28% of MSW. Nearly one dollar out of every ten that Americans spend on food and beverages pays for packaging.

Decisions consumers make every day affect more than the amount of waste they bring home from the store. These decisions influence the type of items grocers stock on the shelves, the recycled content of products, and even the items or the packaging that manufacturers produce for consumers. Looking at our buying habits and the ways we treat our trash is one of the first steps to taking action that will reduce waste and help us create a sustainable future!

Management Suggestions:
1. For younger students, use the Consumer Survey for Students in class and have them take the Survey for Older Students and Adults home for the family to complete. Older students who make more consumer decisions can gain insight form the Survey for Older Students and Adults.
2. For the youngest students, read the quiz out loud and have the them raise their hands for never, sometimes, or often. Discuss the terms and choices as you proceed. Have students count and keep track of the tally for each category.
3. Students could administer the quiz to other classes. Statistics can be generated for average scores for grade, classes, teachers, administrators. Compute averages, record on graphs.
4. Use the quiz as a pre/post test for student behaviors.
5. Use the responses to the survey to help set priorities for action projects.
6. Students can develop their own survey by brainstorming behaviors that promote waste reduction and conservation. The y will enjoy giving their survey to others!

Procedure
1. Introduce the Source Reduction/Recycling Quiz by asking students how they think they contribute to the waste stream. Encourage them to be honest in answering the questions, that there should be no "competition" for a low or a high score. This quiz is a teaching tool to help them understand the choices they make every day which can help or harm the environment.
2. Pass out the quiz and have students complete it, then score it themselves.
3. Discuss each item on the quiz to determine how the action influences the waste stream.
4. Tally the total score for the class and find a class average.
5. Have students take the quiz home and give it to parents, relatives, and friends. Compare the scores with the class average, and discuss what they were able to teach others about waste reduction and recycling strategies.

Self Evaluation

Discussion Questions

1. Which of the actions described on the survey don't require any more work or time? Which are the most difficult to do "often."
2. How can you convince yourself the actions are worth the effort? How can you convince others?
3. How do consumer choices (demands) influence store owners and manufacturers? Can talking to owners make a difference?
4. How else can you influence the choices of goods available in the stores?

Source Reduction/Recycling Quiz
Consumer Survey for Students

Think about the things you do that can help reduce waste. Circle the number in the column that says how often the question is true for you. Add up the circled numbers in each column to find your total score. Use the information in "Scoring the Survey" to rate your score.

	never	some of the time	often
1. Do you wear hand-me-downs or buy second-hand clothes?	3	2	1
2. Do you make sure to put the tops back on markers so they don't dry out and you don't have to buy new ones more quickly?	3	2	1
3. Do you take good care of toys and personal belongings so they won't break and you have to throw them out?	3	2	1
4. Do you use envelopes from junk mail or reuse old envelopes to carry lunch money, book orders, or notes to school?	3	2	1
5. Do you write or draw on the back of paper that has already been used?	3	2	1
6. Do you borrow books from the library or swap with your friends to avoid buying new books and magazines?	3	2	1
7. Do you use toys or games that don't need batteries or use electricity?	3	2	1
8. Do you ride your bike or walk to visit friends rather than driving in a car and using gasoline?	3	2	1
9. Do you turn off lights, television, and radios when you are not using them?	3	2	1
10. Do you avoid buying individually wrapped snacks for school?	3	2	1
11. Do you reuse plastic bags (such as bread bags and plastic liners in cereal boxes) or use Tupperware containers when you bring lunch or snacks to school?	3	2	1
12. Do you recycle the things that can be recycled in your community?	3	2	1
13. Do you have a compost pile or a worm bin for your garbage at home?	3	2	1
14. Do you bring your own shopping bags to the store?	3	2	1
15. Do you talk to your friends or family about reducing, reusing, or recycling?	3	2	1
Column Totals	___	___	___
Grand Total			___

Source Reduction/Recycling Quiz
Consumer Survey for Older Students and Adults

Every day we make choices that affect the amount of waste we produce. Consider your behavior, the choices you make and your contribution to the waste stream. Add up the circled numbers in each column to find the column totals then add them together to find your total score. Use the information in "Scoring the Survey" to rate your score.

Do you ...	**never**	**some of the time**	**often**
1. choose to buy an item because it has less packaging?	3	2	1
2. consider the recyclability of an item before you buy it?	3	2	1
3. choose not to buy some things you want because you don't really need them and it would be wasteful?	3	2	1
4. think about what will happen to a product or a package when you no longer have any use for it?	3	2	1
5. try to reuse things you already have rather than buy new products?	3	2	1
6. wash out and reuse plastic bags in your home?	3	2	1
7. consider what pollution and wastes were created in the manufacture of the things you buy?	3	2	1
8. use the recycling facilities in your community?	3	2	1
9. use dishcloths, sponges and cloth napkins instead of disposable paper products?	3	2	1
10. avoid items such as disposable diapers, razors, lighters and pens when longer lasting alternatives are available?	3	2	1
11. ask that less wrapping be used when you order take-out food?	3	2	1
12. compost kitchen waste and other decomposable organic matter?	3	2	1
13. bring your own shopping bags to the store?	3	2	1
14. buy items from bulk supplies in the store?	3	2	1
15. talk to store managers about stocking bulk items and avoiding packaging?	3	2	1
16. spend the money to repair an item even though you could get a new one for nearly the same price?	3	2	1
17. look for and buy products made from recycled materials?	3	2	1
18. return beverage containers rather than put them in the trash?	3	2	1
Column Totals	___	___	___
Grand Total			___

Self Evaluation

Scoring the Survey

Consumer Survey for Students

If your score was:

36 OR MORE

Like most people you are throwing more trash away than you need to. It's easier to tell other people what they should do than it is to change your own habits. Learn how to make less waste in the first place, and you will be part of the solution!

What can you do? Be aware of the amount of trash you generate each week. Not how heavy it is, but how much of it could be reused, recycled or avoided entirely. Next time you go to the store, check to see if any of the products you normally buy in non-recyclable containers are also available in reusable, refillable or recyclable containers. Avoid products with excessive packaging. Reuse your paper and plastic bags when you shop or take your own cloth or string bags with you.

BETWEEN 23 AND 35

You are making some effort to reduce waste. You need to do these things more often and think about other things you can do to help reduce waste even more.

What else can you do? Look carefully at the things you throw away, is there any way you could reuse containers or wrappings? Better yet, is there a way you could have not gotten those items in the first place? Talk to other people how they reduce, reuse, and recycle.

22 OR LESS

You're obviously working hard to reduce waste. It shows!

Think about the things you do to keep trash out of the waste stream. Which are you most proud of? Encourage your friends and family to consider doing the same. Help get projects started in school and at home to make your work even more effective. Keep up the good work!

Consumer Survey for Older Students and Adults

If your score was:

44 OR MORE

Like most Maine residents, you are probably contributing your full share of trash to our rapidly diminishing landfill space including tons of usable, recoverable materials. By your consumer habits you are also encouraging manufacturers and storekeepers to market wasteful products and packaging and discouraging markets for recyclable goods.

What can you do? Be aware of the amount of trash you generate each week. Not how heavy it is, but how much of it could be reused, recycled or avoided entirely. Next time you go to the store, check to see if any of the products you normally buy in non-recyclable containers are also available in reusable, refillable or recyclable containers. Avoid products with excessive packaging. Reuse your paper and plastic bags when you shop or take your own cloth or string bags with you.

BETWEEN 29 AND 43

You are doing some reducing, reusing and/or recycling. These patterns need to be practiced consistently by the majority of the population if we are going to reduce the increasing amounts of waste.

What can you do? Do some comparison shopping. Consider various types of packaging and the alternatives that are available. Consider buying products in larger quantities or in bulk quantities. Reuse your paper and plastic bags when you shop or take your own cloth or string bags with you.

29 OR LESS

You've obviously done some serious thinking about the need for resource conservation. It shows!

Think about the things you do to conserve. Which are you most proud of? Encourage other people to consider doing the same. Get involved in solid waste planning in your community. Keep up the good work!

Adapted by the Chewonki Foundation, the Natural Resources Council of Maine and the Maine Waste Management Agency Office of Waste Recycling and Reduction, from the Rhode Island Dept. of Environmental Management, Waste Education Curriculum and the Oregon Dept. of Environmental Quality, Solid Waste Division. The Student Survey was developed by Helen Sahadi, Thorndike, Maine.

Self Evaluation

Home Waste Audit

Key Question
How much trash does my family generate?

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials
bags for collecting and separating trash

gloves

data record sheets

Related Pathways to Action Projects
- *"Junk" Mail Reduction Effort*
- *Used Clothing Drive and Swap*
- *Magazine Reuse Campaign*
- *Trash-to-Art Festival*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*
- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*

Overview
This is an inventory to help students and their families determine how much waste they generate at home. It involves having each household collect, separate, weigh, and analyze their trash. A form is included for recording data from the audit. Separate forms for recording food waste and junk mail are also included. The audit can be designed for any reasonable time period. The inventory can help identify priorities for Pathways to Action Projects and it can help motivate students to reduce waste outside of school.

Objectives
Students will identify the types of waste and the amount of waste produced at home. They will identify strategies to help their families reduce waste.

Background Information
The U.S. Environmental Protection Agency estimates that in 1992 each person in the country contributed 4.3 pounds to the stream of Municipal Solid Waste (MSW.) This figure is an average of the waste produced by households, businesses, government offices, and schools. Most individuals produce less than the average 4.3 pounds per person, yet each one of us should still ask "How much waste do I create?" and "How can I create less waste?"

In general, people in the United States are generating more waste each year. Maine people, in contrast, generated less trash in 1992 than they did in 1988. This shows the commitment of Maine people to reducing MSW, but more work needs to be done. The Maine Waste Management Agency set a 1994 goal for the state as a whole to reduce the municipal solid waste stream by 10% below 1988 levels.

The home waste audit is a starting point for students and their families to evaluate their own contribution to the Municipal Solid Waste stream and take action to reduce!

Planning the Home Waste Audit
1. Communicate with parents to get their support for the home audit. Decide on the amount of time for the home waste audit (the form is designed for a two-week collection period.) An adult should be encouraged to help students at home to ensure safety and cleanliness.
2. Students can use the Household Waste Data Audit Form to collect data at home and they can tabulate the information in school. Compare the figures to waste production at school.

Procedure
1. Define MSW and discuss the items each household contributes to the waste stream. For a more complete description of MSW, see Background Information Overview.
2. Identify the sorting categories listed on the form. Separate the items according to the categories of recyclable material accepted by your local recycling center. For example, be sure your definition of "office" paper is consistent with the paper accepted by the center.
3. Review the process of collecting and weighing trash at home (use suggestions in the School Waste Audit activity.) Emphasize working with an adult, and ensuring cleanliness and safety. Look over the data form to familiarize students with the categories.
4. Have small groups practice the process by separating and weighing classroom or other school trash.
5. Analyze the data as described in the School Waste Audit activity.

Household Waste Audit Data Form

Household Information

Name_____(Circle one) house or apartment

Address _____

Phone_____ Number of people in the household and their ages _____

What pets do you have?_____ Do you have a yard? _____ How large?_____

What do you usually do with your yard waste (compost, transfer station, stump dump, garbage pickup)?_____

Do you currently recycle? _____ If yes, what materials? _____

Waste Data

1. Estimate the annual amount of the following waste that your household generates.

tires _____ _____ white goods (large appliances) _____

stump dump material (stumps, wood, trees, etc.) _____

yard waste (grass clippings, brush leaves, etc.)_____

2. Household waste data (up to 2 weeks) Date Start _____ Date Finish _____

	Weight	Days	Weight	Days	Weight	Days	Weight	Days
newspaper								
"office" paper								
mixed paper								
magazines & catalogs								
recyclable HDPE #2 plastic								
other plastics								
glass								
aluminum								
tin cans								
food waste								
corrugated cardboard								
# bags yard waste								
other (diapers, etc.)								

This form was adapted from the form used by the Yarmouth Waste Reduction and Recycling Committee.

Self Evaluation

Home Household Hazardous Waste Audit

Level
- ■ Intermediate
- ◆ Advanced

Materials

hazardous products collected from the school (for demonstration)

household Hazardous Waste Audit Form

alternative products information sheet

Key Questions

What household hazardous materials do I have in my home? What should I do with them?

Overview

This is an inventory to help students and their families determine the household hazardous substances they use, store, and discard at home. The inventory involves locating, identifying, and recording household hazardous products. The audit can help families develop strategies to reduce their dependence on hazardous materials. Students should be familiar with the issues of household hazardous wastes before beginning this audit (see the awareness activities: Moving toward Source Reduction, and Pollution Prevention, Getting to the Route of the Household Hazardous Waste Problem, or Test the Alternatives.) Special precautions must be followed to ensure student safety during the audit.

Objectives

Students will identify hazardous materials found in the home; they will understand the dangers of improper disposal of household hazardous wastes; they will identify ways to reduce household hazardous wastes.

Background Information

Many household products contain ingredients which can be hazardous to people or the environment. These ingredients can be poisonous, flammable, corrosive and/or cause violent chemical reactions. Hazardous products generally fall into five categories: automotive products, cleaning and polishing materials, paint and related solvents, pesticides, and miscellaneous items (e.g. batteries, some cosmetics, shoe polish.) Unwanted portions of these products and their containers become hazardous waste.

The products most likely to contain hazardous materials include (but are not limited to):

Cleansers

(the most hazardous examples)

- ***furniture polish***
- ***oven cleaner***
- ***drain opener***
- ***spot removers***
- ***toilet bowl cleaner***

Car Products

- ***motor oil***
- ***antifreeze***
- ***car batteries***

Pesticides

- ***flea powder/collar***
- ***insect repellent***
- ***weed killer***
- ***garden insect spray***

Paint and Paint-Related Products

paint
wood preservative
wood stain
paint brush cleaner

Other Household Products

ni-cad (nickel-cadmium) batteries
small, sealed lead-acid batteries (as used in emergency lighting)
shoe polish
fingernail polish and remover
rubber cement

Improper use, storage, and disposal of hazardous products can cause serious environmental problems. If they are not completely used or disposed of in an approved hazardous waste facility, most hazardous wastes eventually seep into waterways or into the ground water. There are local and state collection programs for the disposal of waste oil, batteries, and waste paint. The household hazardous waste picture should look brighter in the next few years as the Maine Waste Management Agency develops programs for managing household hazardous wastes.

Management Suggestions

1. Communicate with parents to get their support for the home audit. An adult should be *required* to supervise or assist students as they do the audit.
2. Introduce the topic of household hazardous wastes by doing one of the hazardous waste Awareness Activities.
3. *Students should not be made to feel any competition, or that they will be embarrassed by identifying hazardous materials they may have in their homes.* The goal of the exercise should be to get accurate information and generate solutions for dealing with a difficult community problem. Students should not be required to do a home audit if adult supervision is not possible.

Procedure

1. Review the issues surrounding household hazardous wastes.
   - Many products we use contain hazardous ingredients.
   - Improper disposal can harm the environment.
   - There are limited approved disposal options for households.
   - Less harmful alternatives are usually available.
   - We need to reduce production of household hazardous wastes.
2. Brainstorm a list of hazardous products students think they have in their homes. Discuss what makes these items hazardous.
3. Examine the audit form and discuss the procedures for taking the household audit.
4. Review the cautions listed on the form. Emphasize parent approval and participation.

Analysis and Discussion

1. Combine lists to identify the most common products in students' homes.
2. What makes the materials listed hazardous?
3. How should different items be disposed of?
4. What alternative products are available?
5. What can students do to inform others about the dangers of household hazardous wastes and the alternatives to using hazardous products?

Related Pathways to Action Projects

- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Home Household Hazardous Waste Audit

Student Name _____ Audit Date _____

Adult Signature _____

Complete this audit with an adult member of your family. Do not open any hazardous product containers, use the information on the labels. Check the locations in your house where hazardous products might be stored. Look in the kitchen, bathroom, laundry room, cellar, garage.

The products most likely to contain hazardous materials include (but are not limited to):

Cleansers (the most hazardous examples)
- furniture polish
- oven cleaner
- drain opener
- spot removers
- toilet bowl cleaner

Car Products
- motor oil
- antifreeze
- car batteries

Pesticides
- flea powder/collar
- insect repellent
- weed killer
- garden insect spray

Paint and Paint-Related Products
- paint
- wood preservative
- wood stain
- paint brush cleaner

Other Household Products
- household batteries
- shoe polish
- fingernail polish and remover
- rubber cement

Location	*Product Name and Use*	*How often is it used?*	*Why is it hazardous? (toxic, flammable, corrosive, reactive)*	*What safer alternative could be used instead?*

Check to see which household hazardous wastes are collected (for reuse, recycling, or disposal) in your town or nearby. Consider using alternative products in the future.

Local Waste Management Options

Key Question
If there is no such place as "away," where does our trash end up?

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Materials
Local Waste Management Options flow chart

Overview
Each town or region has different facilities for processing trash. The "rules" for recycling vary greatly from place to place in Maine. This activity helps students identify exactly what happens to their trash. The people who handle trash and recyclables visit the classroom, or the students go on field trips to visit facilities that handle their trash. Students mark on a flow chart the route each type of trash or recyclable takes.

Objectives
Students will identify the final destinations of different kinds of wastes in their community and the routes all of their trash takes after it is thrown "away."

Background Information
Every community disposes of solid waste, but no two communities do it in exactly the same way. Most citizens don't know what happens to their waste after they throw it "away." Before they can really appreciate the need to produce less waste, and make the effort it takes to change consumer patterns, every person should know what happens to each type of waste they create. How much of their waste is recoverable, how it is recovered, and how much is "unrecoverable?"

Unrecoverable waste is sent to a landfill or incinerator. Where is your landfill? What incinerator does your town use? Options are being developed for recyclable, compostable, and returnable (redeemable) materials. Most communities have programs to recycle some types of waste. What is recyclable in your town? Where do these things get recycled? Can you get yard waste or food waste composted? Because of Maine's returnable bottle law many types of containers are redeemed for deposit. Where do the bottles go after you take them to the redemption center? Answers to these questions will help clarify how waste is managed in your community.

Management Suggestions
1. Talk with the town (or regional) solid waste manager to understand the waste options in your area.
2. Work with your custodian to learn about how the school trash is handled: Who is the hauler? Where is the trash taken?
3. Plan a field trip to your recycling center, transfer station, and a redemption center, or invite operators of each to discuss where the trash goes in your town. Consider inviting the custodian and trash hauler.
4. Plan a field trip to the landfill or incinerator where the trash from your town is sent or invite an operator to show slides of the facility. Learn how the facility is managed and determine what happens to most of your trash when it is thrown "away." The background information sections on Landfilling and Incineration describe what happens in each type of facility.

Self Evaluation

Local Waste Management Options

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *Used Clothing Drive and Swap*
- *Magazine Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Procedure

1. Brainstorm ideas with students about where their trash goes. Try to get their ideas of the steps it takes to get to the "final resting places" of different types of trash.
2. List questions that students have and decide how they can get their questions answered.
3. Take a field trip or invite speakers to provide information for students.
4. Using the flow chart, have students color in the arrows to show the pathways of the different types of trash. Color in only the pathways that are available in your community. Write in the details (name of the recycling center, trash hauler, etc.) for your town. List examples of reusable items.

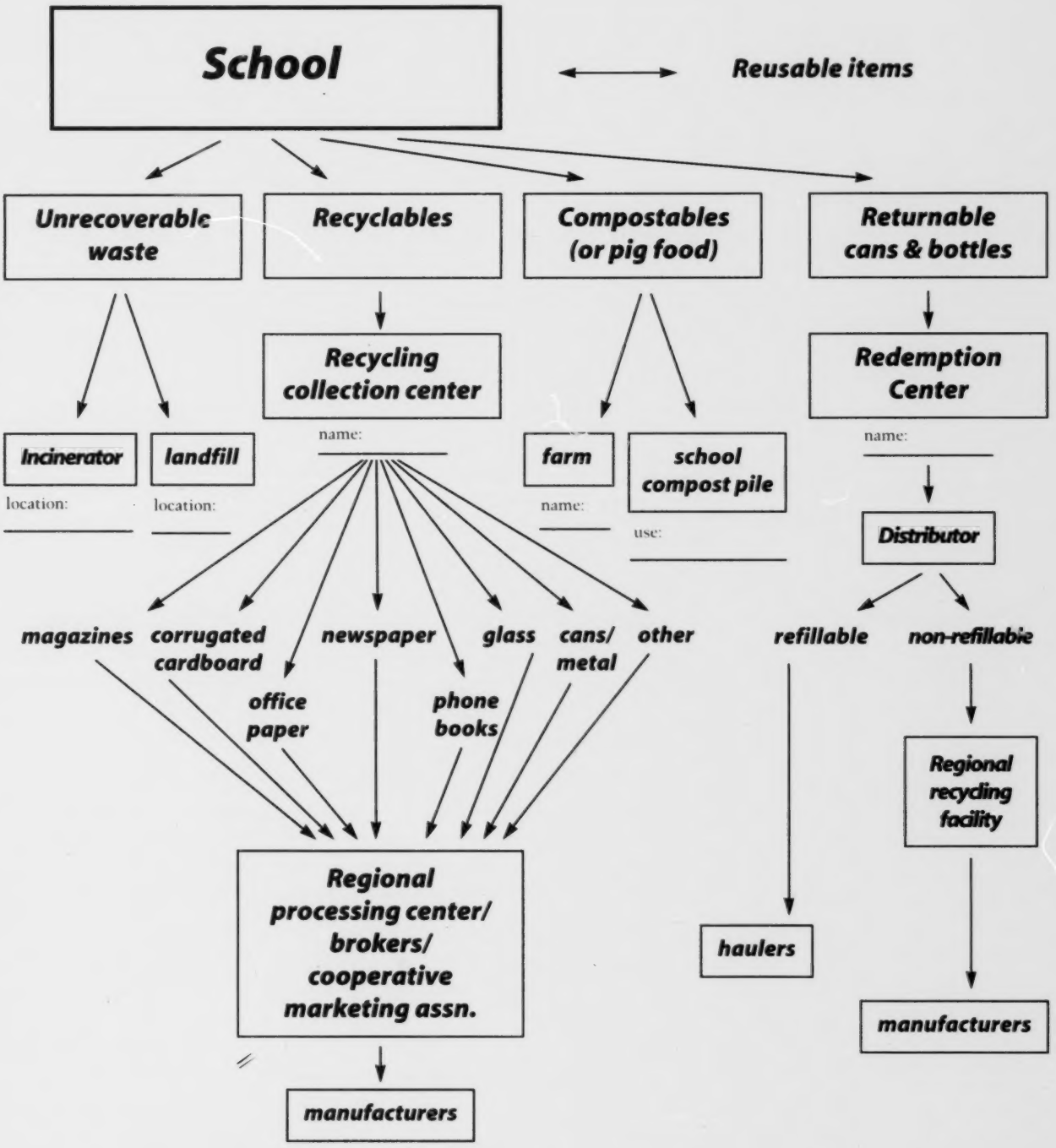
Discussion Questions

1. Can you really throw your trash away?
2. Where is the landfill or incinerator used by your town?
3. How do recyclables get recycled?
4. What compostables can be recovered? How?
5. What happens to returnables after you take them to the redemption center?

Local Waste Management Options Flow Chart

Student name: _____
School: _____
Town: _____

Directions: Color the arrows to show where each type of trash in your town goes.. Write in details of the names of the facilities in your town.



Self Evaluation

Trash Sorting Relay Race

Level
■ *Intermediate*
◆ *Advanced*

Key Question
How should trash be separated in our community?

Overview
This is an active relay race for two teams, or a "race against the clock" for one team. The challenge is for students to separate a pile of trash into categories for recycling, reuse, composting, or disposal. The categories are set according to the services available in your own town. The activity reinforces the students' knowledge of proper separation and prompts discussion about techniques for reducing waste.

Materials
gloves (cotton work, large)
1 pr. for each team

boxes (5 for each team) labeled:
To the landfill *or* **To the incinerator**
(your local) Recycling Center - ***separate this box in to sections for specific recyclables if you like***
Redemption Center
Miscellaneous Reusables: art, science, craft projects; storage containers
Compost

1 large trash bag filled with a variety of cleaned/dry trash for each team

paper - school paper with one blank side, envelopes with plastic windows, junk mailings, magazines, newspapers, paper bags, glossy paper, paper plates, cups, napkins

cardboard and paperboard - cereal boxes, egg cartons, etc.

plastics - yogurt containers, milk jugs, shampoo bottles, plates, utensils, packaging, plastic bags, balloons, etc.

glass - sturdy bottles (like salad dressing)

returnable cans and bottles - plastic, glass, aluminum

tin cans - soup cans, spice containers, aluminum foil

disposables - diapers, broken toys, scraps of cloth, etc.

polystyrenes - foam meat trays, foam cups, etc.

NOTE: Any multi-layered packaging is a great stumper

Objectives
Students will distinguish recyclable and nonrecyclable materials and identify recycling categories of material which is recyclable in their town. Students will identify strategies to reduce the amount of waste destined for the landfill or incinerator.

Background Information
Each town has a specific trash collection and separation procedure. This activity should model the separation process used in your town. Label the collection boxes to correspond to the categories collected curbside, at the transfer station, at the local recycling center, redemption center, or other facility. Determine the destination of non-recyclable wastes - landfill or incinerator.

Management Suggestions

1. This is a relay race. Two teams can compete against each other or one team can race against the clock.
2. Allow enough cleared space for the teams to run and place the items in the boxes.
3. Line up the boxes so that each team can read the choices for waste disposal.
4. Explain that whenever one handles trash, gloves should be worn. Discuss why (hygiene, safety, etc.)
5. Plan to follow-up this activity with action steps in the classroom to reduce the amount of trash sent to the dumpster.
6. Present awards to each team or team member to recognize their commitment to waste reduction.

Procedure

1. Team members stay behind the designated starting line.
2. Place a full bag of trash for each team between the starting line and the boxes.
3. Announce the process to each team:
   a. The first person in the line puts on the gloves then reaches into the bag and pulls out two items.
   b. The player then runs to the boxes and decides how to dispose of both items. He or she may consult with team members if necessary.
   c. When the items are in the proper boxes, the player removes the gloves and hands them to the next team member.
   d. The race is over when all the items from one team's bag have been placed in the boxes. You may want to end the race when even the large trash bag has been placed in a box.
4. Examine the contents of each box and discuss the results.
5. Follow up this activity with an action session where plans for waste reduction can be put into motion.

Discussion Questions

1. Which boxes got the most waste? Which got the least? What does that tell us about our waste?
2. What items were students unsure about? Could some items have been put in a different box?
3. How can we reduce the amount of trash in the landfill (or incinerator) box? (What alternatives to those products or packaging do we have?
4. What items do we generate in the classroom (school) that could be removed from the landfill (or incinerator) box? What should we do with them?
5. What else can we do to reduce the amount of trash we generate?

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *Magazine Reuse Campaign*
- *Trash-to-Art Festival*
- *School Recycling Program*
- *Home Recyclables Collection Center*

Adapted from an activity designed by Bob Olney, teacher at Waynflete School in Portland, Maine.

Pathways to Action

Action projects to make a difference

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

This section contains a number of action steps that students can undertake. They all help effect change in the way we think about and manage waste. Some activities focus on the classroom, some are directed towards the school at large, and some deal with waste management issues at home and in the community. Their collective goal is to involve students and teachers with real issues and creative solutions to our current waste management problems. They utilize the students' current knowledge, encourage students to investigate further, and challenge students to act.

Simple Classroom Action Projects 105

Source Reduction Projects 107
1 in the Waste Management Hierarchy

Classroom Source Reduction Campaign ● ■ ◆ 108

Cafeteria Source Reduction Campaign ● ■ ◆ 109

School Source Reduction Publicity Campaign ● ■ ◆ 111

"Junk" Mail Reduction Effort ● ■ ◆ 112

Reuse Projects 117
2 in the Waste Management Hierarchy

Classroom and Office Paper Reuse Campaign ● ■ ◆ 118

Used Clothing Drive and Swap ● ■ ◆ 119

Magazine Reuse Campaign ● ■ ◆ 120

Trash-to-Art Festival ● ■ 121

Recycling Projects 123
3 in the Waste Management Hierarchy

School Recycling Program ● ■ ◆ 124

"Buy Recycled" Campaign ■ ◆ 126

Home Recyclables Collection Center ■ ◆ 130

Composting Projects ***133***
④ *in the Waste Management Hierarchy*

Classroom Worm Bin Project ● ■ 134

Cafeteria Composting Project ● ■ ◆ 137

Plans for Constructing Composting Bins 140
Wire Mesh Holding Unit *140*
Wooden Pallet Holding Unit *141*
Wood-and-Wire Three-Bin Turning Unit *142*
Garbage Can Composter *144*

Incineration and Landfilling Projects ***145***
⑤ & ⑥ *in the Waste Management Hierarchy*

Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy ■ ◆ 146

Landfill Siting Investigation ◆ 148

Household Hazardous Waste Action Projects ***153***

Promoting Alternatives to Hazardous Products ■ ◆ 154

Waste Paint Exchange Project ■ ◆ 155

Battery Use Reduction and Rechargeable Battery Promotion ■ ◆ 157

Tools for Action ***159***

Letter Writing For Results 160

Publicity 162

Public Service Announcement 164

Pushing for a Change 168

Pathways to Action

Featured Teachers and Other Programs 171

Creative programs in Maine Jr. High and High School classrooms and additional valuable programs available to Maine schools

Gail Adshead – Garbology Unit, Cape Elizabeth High School 172

J.B. Kavaliauskas – The Raging Recycling Riots, South Portland High School 176

Ernest Kozun, Jr. – Jr. High Recycling Program, Windham Middle School 179

Mary K. Wells – Household Hazardous Waste, Warsaw Middle School 182

Sue West & Dave Leibmann – Solid Waste Service Projects, Maine Coast Semester Program 185

David Wilkins – Student-run Summer Camp, Katahdin High School 188

Other Programs 192

Waste Away 192
Maine Model Business/Community Program 192
Governor's Waste Reduction Award Program 193
Coast Week 194
Kids' EcoTeam Program 194
KIDS (Kids Involved Doing Service) 195
The Critical Skills Program 195

Simple Classroom Action Projects

Overview

In these short action projects or classroom waste challenges, students can take immediate steps to reduce the amount of waste they generate. Each project helps students understand behaviors which create unnecessary waste in school and provides opportunities for them to reduce waste at home. Each of these projects can be initiated with little or no preparation and can even be started before any other activities in Pathways to a Sustainable Future. These Simple Classroom Action Projects can be gateways into other Awareness Activities, Inventories, or other Pathways to Action projects contained in this guide.

Related Activities

- *Drop in the Bucket*
- *How Much Trash!*
- *Mounting Milk Cartons*
- *If Toys Could Talk*
- *Everyday Choices for a Sustainable Future*
- *For Better or Worse*
- *Are Ten Better Than One!*
- *Paper, Plastic, or Cloth!*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Planning Considerations

1. Have students choose which immediate classroom action project(s) they want to try. Their choice should reflect the apparent waste needs of the classroom, and they should be motivated to make the project successful.
2. Another approach is to challenge students by presenting them with an unusual situation in the classroom (e.g. having them come into the room one morning and have no wastebaskets available for their trash - see Personal Trash.) Use the shock value to discuss the problem the situation presents and generate suggestions for dealing with the problem.
3. The project suggestions listed below are merely starting points. Students or the teacher might have other ideas that would be just as easy to initiate and would more closely meet the specific needs of the classroom.
4. Use the awareness and motivation generated by these simple action projects to follow through with Pathways to Action projects.

Action Project Suggestions

1. Collect Personal Trash

Challenge the class by removing all wastebaskets in the classroom. The goal is to minimize the waste each person produces. Because there will inevitably be some waste production, tape a small (or medium size) bag to each student's desk to collect discards for a day (or a week.) Consider cleanliness and sanitation by collecting all compostables in a separate leak proof container.

Weigh and record the amount of trash collected. This data can be used in a School Waste Audit. Discuss the reasons the waste was generated and possible ways to reduce the amount of waste the class generates. Compare the classroom waste to trash produced at home, and discuss ways for students to reduce household waste.

2. Collect Compostable Waste

Use a large plastic bucket with a cover to collect compostable food waste from snacks or other sources in the classroom. Weigh and record the amount collected daily. Brainstorm ways to reduce the amount of waste produced. Further challenge students to form a **"No Waste Club"** for snacks or lunch. Have a student

Simple Classroom Action Projects

Action Project Suggestions cont.

volunteer take the waste home to a compost pile.

Make plans to start a classroom worm bin or compost system for the school which might accommodate all classrooms and the cafeteria/kitchen waste (see Pathways to Action Composting projects.)

3. Replace Wastebaskets

Parkinson's Law humorously states that "work expands to fill the time allotted to it." The modern corollary, **Parkinson's Law of Garbage,** states that "garbage expands to fill the space allotted to it!" If you have smaller wastebaskets in the classroom, a natural consequence may be that you will generate less waste.

Try replacing the wastebaskets in the classroom with smaller ones to force the issue of creating less waste. When students realize that there is not enough room to throw things away they will be more motivated to reduce the amount of waste they generate. Discuss ways to reduce classroom waste. Consider strategies that may help make others (students, school administration, families) aware of the amount of waste they produce and will encourage waste reduction.

4. Remove Paper Towels

Paper towels are a consumable item that adds to the classroom waste stream. Challenge students to find alternatives to using disposable paper at the classroom sink. A common solution is to provide a supply of washable hand towels that are laundered weekly by parent volunteers.

This is a clear example of the small sacrifice of convenience it takes to reduce waste from disposable products. Acceptable alternatives should not compromise health standards.

5. Use Paper on Both Sides

A common solution to reduce paper waste in classrooms is to reuse paper until all surfaces are covered. Challenge students to reduce the amount of paper that is used and discarded. Brainstorm ways to save paper and design a system to use paper more efficiently. The system might include a usable paper collection box, reusing the blank side for practice work or projects, trimming smaller usable pieces and stapling into notepads. Collect completely used paper for recycling (see School Recycling Pathway to Action.)

6. Collect and Recycle Foam Packing "Peanuts"

Anyone who receives mail-order packages seems to get overrun with foam peanuts. Have students collect all the peanuts that come into the school, and add any that they can bring in from home. The class can reuse them at holiday time to pack and mail gifts, or take them to a local Mail Boxes, Etc. or another retail mailer to be recycled (or to be reused). The Plastic Loose-Fill Producers' Council (800-828-2214) can tell you the location and phone number of the closest peanut "recycler." Save the foam peanuts in a large trash bag and take it in to be reused whenever it's full. Large collection centers may send the peanuts to a manufacturer to be recycled into new foam. Although recycling the peanuts will help reduce waste, it may help even more if your students write to the mail-order shippers and encourage them to use biodegradable peanuts made from starch instead of the plastic ones which don't degrade.

Follow-Up

- Discuss how the challenge posed to the class changes the way they think about the problems of waste. Is it possible to generate less waste without changing our behavior?
- List the most wasteful behaviors and the areas at school that generate the most waste. How can that waste be reduced?
- Plan a waste audit for the classroom, school, or home (if this has not already been done.)
- Decide on the most appropriate Pathway to Action which addresses the waste issues most important to the class.

Source Reduction Projects

1 in the Waste Management Hierarchy

Source reduction, the process of decreasing the amount of waste that humans generate, is one of the key actions that we can all take to manage our waste successfully. It includes intelligent design and manufacture of durable products, elimination of unnecessary packaging, and efficient product use. Much progress remains to be made in the area of source reduction in our country, especially regarding packaging. Consider that each year, one half of all the municipal solid waste generated in America by volume and one third of the waste by weight comes from packaging.

Source reduction is common sense. The best way that we can deal with our waste is to stop producing so much! The following Pathways to Action use this common sense approach to reduce waste in classrooms, schools, and towns.

Source Reduction Pathways to Action

Classroom Source Reduction Campaign 108

Cafeteria Source Reduction Campaign 109

School Source Reduction Publicity Campaign 111

"Junk "Mail Reduction Effort 112

Success Story

For a decade, Livermore Falls Grammar School students ate their hot lunch on disposable polystyrene trays with disposable plastic utensils, and drank their milk from paper cartons. All the lunchroom trash went into the dumpster, and sat outside Mrs. Spiotta's fifth grade classroom window. The fifth graders watched the junk pile up every day before it was hauled off the landfill. In 1990, Mrs. Spiotta decided to do something about the mess. With the help of students and parents she began separating the milk cartons, rinsing them out, and taking them in her own car to a local paper mill to be recycled. That was a little better, but not good enough. There was still all that Styrofoam; and it piled up again every school day!

In the fall of 1991, Mrs. Spiotta and her class got down to work to reduce the source of the lunchroom trash. They figured that the only way was to change the way lunches were transported from the high school and served at the Grammar School. They researched the cost of buying reusable trays, utensils, insulated trays, ovens, and of hiring staff to serve the food. They subtracted the cost of disposable dishes and tipping fees for the trash and set their fundraising goal to make up the difference. When they took their argument before the School Board everyone knew the "right" thing to do! Because the Board was worried about the cost, they challenged the school to provide most of the start-up money. The student council made a contribution and a community supper brought in a lot more.

Now, students at Livermore Falls Grammar (recently renamed the Intermediate Learning Center) eat from sturdy reusable dishes and utensils. The fifth graders look out the window and see a neat storage area. In fact, their next project was to build a new storage shed for all the recyclables separated from school trash. The recyclables are now picked-up by an independent hauler and taken to the Jay Recycling Center.

Classroom Source Reduction Campaign

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Project Length
2 class periods

Related Activities
- *Drop in the Bucket*
- *How Much Trash!*
- *Mounting Milk Cartons*
- *Bread and Kisses*
- *Everyday Choices for a Sustainable Future*
- *Test the Alternatives*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview

In this action project, students develop strategies to reduce classroom waste and to incorporate their ideas into the daily operation of the classroom.

Background

Source reduction, the attempt to decrease the amount *and the toxicity* of solid waste produced, is the highest waste management priority identified by the U.S. EPA and the Maine Waste Management Agency. The most efficient, inexpensive, and environmentally sound method of managing municipal solid waste is simply to avoid producing it in the first place. Waste that is never created does not need to be collected, requires no transportation, takes up no landfill space, creates no pollution, and costs nothing to handle.

See the background information section on Source Reduction.

Planning Considerations

1. The School Waste Audit (classroom waste) will provide important information at the beginning of this project.
2. Students are likely to suggest some waste reduction strategies that may be unworkable in the classroom. If possible, allow enough time to develop these ideas further into workable solutions.

Suggestions for a Successful Classroom Campaign

1. Examine all the waste in the classroom trash can with the students. Allow time for discussion and keep lists as the discussion warrants.
   - Which disposable items in the trash could be replaced by durable, reusable items?
   - Which items could be eliminated altogether?
   - Which items must be thrown away?
2. Brainstorm other ways to reduce waste in the classroom. Potential areas for source reduction efforts include:
   - If the classroom has a sink, are there paper towels at the sink? Can they be replaced with cloth towels? How can the cloth towels get washed?
   - Are there some tasks for which paper is not necessary?
   - Can paper be written on more thoroughly (e.g. writing on the back)?
   - Are students taking care of their books so they can be reused?
   - Can snack foods from home be packaged more efficiently (e.g. fewer bags, fruits unwrapped)?
3. Help the students reach a consensus about what efforts should be made. Choose just a few areas in order to focus the class' efforts. If necessary, get volunteers or assign students to carry out specific tasks related to the source reduction efforts.
4. Make certain that the decisions the class makes are well publicized. Students can make posters to remind the class about the new ideas (e.g. a poster might hang above the paper supply reminding students to conserve). *This may be the most important aspect of the entire source reduction effort.*
5. Involve the students in overseeing the efforts. This will get each student personally invested in the project and help to keep the project operating smoothly.

Follow-Up

- Using any appropriate scale, have students measure the weight of classroom waste that is generated each day. Record the amount of waste at the end of each day. This information can be posted in the classroom to encourage and remind students to reduce waste. Initiate a discussion about what the graph shows and whether or not the source reduction efforts are proving effective.
- School Source Reduction Publicity Campaign. Also try composting classroom organic wastes in a worm bin.

Cafeteria Source Reduction Campaign

Overview

Students take steps to reduce cafeteria waste and limit the amount of trash sent to the landfill or incinerator. They generate ideas and work with food service staff and other students to incorporate new ideas into the daily operation of the cafeteria.

Level

● **Introductory**

■ **Intermediate**

◆ **Advanced**

Project Length

3-10 class periods (depending on the scope of the project); on-going student supervision of progress

Related Activities

- *Drop in the Bucket*
- *How Much Trash!*
- *Mounting Milk Cartons*
- *Bread and Kisses*
- *Everyday Choices for a Sustainable Future*
- *For Better or Worse*
- *Are Ten Better Than One?*
- *Paper, Plastic, or Cloth?*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Background

Source reduction, the attempt to decrease the amount *and the toxicity* of solid waste produced, is the highest waste management priority identified by the U.S. EPA and the Maine Waste Management Agency. The most efficient, inexpensive, and environmentally sound method of managing municipal solid waste is simply to avoid producing it in the first place. Waste that is never created does not need to be collected, requires no transportation, takes up no landfill space, creates no pollution, and costs nothing to handle.

The cafeteria and kitchen are often the largest generators of solid waste in the school community. As such they are a prime target for source reduction efforts.

See the background information section on Source Reduction.

Planning Considerations

1. Get the support of the administration, food service staff, custodians, and other teachers before embarking on a major cafeteria source reduction campaign.
2. Any planned changes in the cafeteria will have to meet state health regulations. Be certain to check with school or state officials about these regulations.
3. This is a creative project! Allow students the opportunity to come up with original ideas and challenge them to follow through on their ideas. Any idea that will reduce waste merits consideration.
4. Students will need discussion time to develop ideas on how to reduce waste. Depending on their level, they may also need help in organizing themselves to push for changes in the cafeteria. They may also need assistance in spreading the news of their initiatives to the entire student body. *The publicity campaign that accompanies any changes in the daily operation of the school may be the most critical part of any source reduction effort.*

Suggestions for a Successful Campaign

1. Take a tour of the cafeteria. Urge students to notice the entire process of food preparation and cafeteria waste disposal. As a class, interview the cafeteria workers about disposal of food wastes.
2. Follow-up the tour by discussing student observations. What steps can be taken to reduce cafeteria waste? Create a chart that lists possible areas for source reduction.
3. Potential areas for source reduction efforts:

● ■ **Introductory and Intermediate Levels**

- Use durable, reusable containers for bringing lunch to school instead of paper bags. Use thermoses in place of drink cans or cartons. Use reusable plastic boxes to keep sandwiches fresh instead of plastic bags.
- Drink milk without straws. Straws are not necessary and are not biodegradable. Though they seem small, they add up very quickly.
- Faculty members can drink coffee out of mugs rather than foam or paper cups if arrangements can be made to wash the mugs. What do teachers use for their coffee in the faculty room?

Cafeteria Source Reduction Campaign

■ ◆ **Intermediate and Advanced Level**

- Students can investigate alternatives to disposable plastic utensils in the cafeteria. How much would it cost to purchase stainless steel utensils, to install a new dishwasher, and to hire someone to operate the dishwasher? Is this more expensive than buying plastic utensils? Which would be more expensive in the long run? What are the environmental costs of each? If it is potentially cost-effective or environmentally sound, students can propose an alternative system of providing cutlery to the school administration. This proposal will be strongest if it includes all the findings about the costs and benefits of several alternatives and proposes a specific plan to the administration.
- Students can explore the possibility of finding alternatives to milk cartons. How else could milk be provided to students? This is a crucial question, as up to two-thirds of lunchroom waste by volume is empty milk cartons! Be creative! Present options to the dairy which supplies milk to the school.

4. Help the students reach a consensus about what efforts should be made. Choose just a few areas to focus the class' efforts. If necessary, get volunteers or assign students to carry out specific tasks related to the source reduction efforts.
5. Publicize the cafeteria waste reduction campaign. Choose a theme, and then have students work in small groups to develop the details of the campaign. Post signs in critical areas to remind students not to waste. The signs should be specific. Make announcements in the morning to the whole school.
6. Involve students in the supervision of the project. This will help keep the project running smoothly and it will keep students invested in the program.

Follow-Up

It is important to assess the outcome of the source reduction efforts. Discuss how the success of the program can be monitored. Has waste been reduced in the cafeteria? How much?

Potential methods of assessing source reduction efforts:

- Develop a survey to be given to schoolmates. The survey can ask students if they have changed their behavior as a result of the source reduction campaign.
- Weigh the cafeteria wastes before and after the campaign. Did the source reduction campaign correlate with a decrease in waste?
- Count the number of straws that are taken from the dispensers before and after the campaign.
- Interview the cafeteria staff. Did they notice a decrease in waste? Have they purchased less? Have they saved money? How much?
- A class discussion about the project can be invaluable. Did students in the class become more aware of what they throw away in the lunchroom? More important, did they reduce their personal waste?

Source reduction efforts can be continued outside the school. Have students discuss ways they can continue reducing waste, and how they can convince others to do the same.

School Source Reduction Publicity Campaign

Overview

Students plan ways to reduce waste throughout the school and to publicize their ideas to the entire student body.

Level
- **Introductory**
- **Intermediate**
- **Advanced**

Project Length
3-5 class periods

Related Activities
- *Drop in the Bucket*
- *How Much Trash?*
- *Mounting Milk Cartons*
- *Bread and Kisses*
- *Everyday Choices for a Sustainable Future*
- *Test the Alternatives*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Background

Source reduction can help shrink the waste stream dramatically with very little work or investment. People simply need to examine their habits, then find ways to change wasteful behavior. Most people want to do the "right thing" but often need a push. This project will help provide that little push!

See the background information section on Source Reduction.

Planning Considerations

1. The School Waste Audit and Home Waste Audit will indicate high priorities for waste reduction activities.
2. After students generate ideas on how to reduce waste, they will need to organize and prioritize them.
3. Students may also need help in organizing themselves to effect a successful publicity campaign.

Suggestions for a Successful Campaign

Developing Ideas and Priorities

1. Begin a class discussion by examining all the waste in the classroom trash can.
   - Which disposable items in the trash could have been replaced by reusable items?
   - Which items could be eliminated altogether?
   - Which items must be thrown away?
2. Construct a list of wasteful behaviors in the classroom.
3. Discuss three or four specific ways that waste could be decreased in your own and in most other classrooms. (See Classroom Source Reduction Campaign.)
4. Consider the cafeteria. Where could waste be reduced in the cafeteria? (See Cafeteria Source Reduction Campaign.)
5. Be sure the discussion touches on other parts of the school, including the library, the office, the faculty lounge, and the art room. How could waste be reduced in each of these places? A walking tour of the specific areas may be very helpful in generating good ideas for waste reduction.
6. Urge students to discuss the ways in which individual awareness can help to reduce waste. For example, getting students in the school to be conscious of the amount of paper they use may be enough to make some significant progress in diminishing waste.
7. Discuss the ideas that have been generated and try to come to a consensus about which ideas are the most interesting for a publicity campaign. When the issues to address have been determined, turn the class attention to the publicity campaign.

Publicity Campaign

1. Decide on a theme to the publicity campaign so that students in the school identify the project as a whole.
2. Call a publicity planning meeting. How will the message about source reduction get out to the school? Some obvious methods come to mind, including posters and school announcements. Others might include a school assembly, a play, poems on the walls, artwork. Several media will help provide variety and reach more students.
3. Divide the class into small groups to work on the various facets of the publicity campaign.

Follow-Up

How successful was the source reduction campaign? Enlist the help of the maintenance staff to try to measure the source reduction, if any, that takes place in the school. How many bags of trash did they collect at the start of the campaign? How many are they collecting after the campaign?

To reach a wider group, plan a Public Service Announcement or Publicity Campaign (see Tools for Action.)

Pathways to Action
Source Reduction

"Junk" Mail Reduction Effort

Level
- ● **Introductory**
- ■ **Intermediate**
- ◆ **Advanced**

Project Length
4 class periods with follow-up sessions

Related Activities
- *Drop in the Bucket*
- *How Much Trash!*
- *Bread and Kisses*
- *Home Waste Audit*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview

Students should complete the junk mail section of either the School Waste Audit or the Home Waste Audit (or both.) Then they analyze the types and sources of the mail, decide which mail is unnecessary or undesirable, and take steps to eliminate the real "junk" mail.

Background

Every year in the United States 55 billion mail order catalogs are sent! That is an average of 250 catalogs for every single person in this country. As much as 44% of these catalogs and other third class mail is never read and goes right into the trash. Direct mail services sell their computerized mailing lists to thousands of advertisers which saturate the mail system with junk mail. Companies also keep their own private mailing lists and sell those lists to other advertisers.

Citizens have privacy rights to prevent their names from being sold for direct mail use. By asking to have your name removed from a mailing list, you should stop receiving unwanted mail from that list or list service. It may take several months, in some cases, to have computer systems updated with your request.

Removing your name from mail preference lists, and direct mail advertisers, can dramatically reduce the amount of unwanted mail you receive. Writing or calling advertisers directly will stop their catalogs and third class mail!

It is possible, however, that your name and address (or some variation of it) will be put back on a list at some point. Those lists are maintained by getting names from many different sources, including the U.S. Post Office. Keeping your name off junk mail lists takes an on-going effort, but the effort will help reduce a huge waste of paper and the energy it takes to transport the unwanted mail.

Write to the following addresses and request permanent removal from all mail marketing lists. Enclose a list of the many variations of your name and address that your have received on junk mail.

ADVO Systems, Inc.
List Services Manager
239 West Service Road
Hartford, CT 06120-1280

Mail Preference Service
Direct Marketing Association
P.O. Box 9008
Farmingdale, NY 11735

A large source of junk mail coming into schools has labels provided by the Maine Dept. of Education. The department provides its mailing list of all schools and teachers in the state to anyone who will pay the cost of printing labels. Although there are important educational uses of the list, over-use of the service produces much unwanted mail in the schools. There is currently no department policy on limiting circulation of the list. According to the Director of Data Processing the department would respond to school concerns about the sale of mailing lists. Teachers, administrators, and students can encourage the Dept. of Education to create a more restrictive policy. They can also try to convince companies to be more selective in mailings to schools thereby conserving natural resources and reducing waste.

Planning Considerations

1. If you do not have a collection of junk mail from either of the waste audits, have students collect all the junk mail that comes to their family and would normally be thrown away for a week or two before the project begins.
2. Communicate with parents about the project and get their support. Be sure students know the difference between junk mail and the third class mail or catalogs that are actually wanted by the family (it's not all junk mail!) Parents can help students sort the mail.
3. Get a signed permission slip from the parents of each student in the class acknowledging that students will be bringing family junk mail into school.
4. Ask office staff and teachers to sort their junk mail that comes to the school, and save it out for your project. Put a (large) box in the mail room.
5. Plan your approach to the Maine Dept. of Education, State House Station 23, Augusta, ME 04333. Coordinate your concerns with the administration and other teachers.

Suggestions for a Successful Effort

Investigating the Problem

1. Have students bring the junk mail they have collected in to school. In small groups, separate the junk mail into several categories. For younger students, the categories might be "Catalogs," "Letters," and "Flyers." More advanced students can attempt to separate junk mail into "Catalogs," "Advertisements," "Solicitations," and "Other."
2. Make a chart that shows what kinds of junk mail each group received. Total up these numbers for the whole class. Figure out the average number of letters received by each family each day.
3. Discuss the following questions, as appropriate:
   - Why do we all get so much junk mail?
   - Is all junk mail bad?
   - What kind of junk mail is most common?
   - Why do companies send catalogues? Advertisements? Solicitations?
   - How do companies get your address?
   - Does junk mail help companies? How?
   - Does it cost money to send junk mail? How much? Is that more or less than it costs you to send a letter? Why?
   - How is junk mail wasteful?
4. Recycle the paper from all pieces of mail.

Addressing the Problem

1. There are ways to stop junk mail! Get students to discuss junk mail with their parents and collect only unwanted junk mail for two more weeks. (Or, decide as a class to collect one kind of unwanted mail, such as catalogues.) At the end of the two week period, have students bring all undesirable mail in from home with a note from the parents indicating that all of this collected mail is, indeed, unwanted.
2. Photocopy the "please remove my ne from your mailing list" letter on the next page.
3. In a working session, have students
   - sort the mail into categories of catalogs that have toll free (800) telephone numbers, postage paid return envelopes, and "others"
   - cut off the label of each piece of mail that has no 1-800 number
   - paste the mailing label on the letter in the appropriate place, sign, and date the letter
4. If the junk mail had a return envelope enclosed, students can use this to mail the letter to the company. Business Reply envelopes will not need postage.
5. If the junk mail did not have a return envelope, any envelope will suffice, although postage will be necessary. *Do not use a return address on these envelopes.*

"Junk" Mail Reduction Effort

6. Have students call the toll free numbers and request that the name on the label be removed from the mailing list. Be prepared with the identifying numbers on the label, and tell the operator why you are making the request.
7. Keep a list of each letter sent or call made for each name.

Follow-Up

- After students have repeated this process for several pieces of junk mail, encourage them to continue the practice at home, with their parents' approval.
- It is possible to continue to receive mail from organizations that they have contacted. If this happens, a forceful second letter is appropriate.
- Two or three months after letters have been sent out to companies, get students to collect junk mail for two more weeks. Bring it in to class again, and compare to the first collection. Does the class receive more junk mail now? Less? Bear in mind that more junk mail comes during holiday seasons.
- Have students list the publications they or their families subscribe to. Then have them contact (mail or call) those subscription services and request that they do not sell, rent, or distribute the name and address to other mailers.
- Discuss ways to teach others how to reduce their junk mail.

Sample letter to have your name removed from mailing lists

Date

Dear Sir or Madam:

Please remove our name(s) from your mailing list effective immediately. We do not wish to receive any more unsolicited mailings of any kind from your organization.

Furthermore, please do not sell, rent, or distribute our name to any other organization for any reason.

For your convenience, we have enclosed the label from the last mailing we received from your organization. Thank you for your immediate attention to this matter.

Sincerely,

Reuse Projects

2 in the Waste Management Hierarchy

Disposables have become a way-of-life for most Americans. Yet single-use convenience products are a large part of the waste stream, and they are a drain on natural resources. The Waste Management Hierarchy calls us to reduce waste at the source first, and second to reuse products so they do not need to be discarded.

Reuse takes many forms. We can reuse a plastic cup for drinking again, or we could reuse the cup for a planting a seed. We can repair broken toys or appliances rather than buying new ones. We can use both sides of paper completely before we recycle it.

It takes imagination to discover ways to reuse products and keep them from the waste stream. The Reuse Pathways to Action could help stimulate student imaginations, and they will devise many more ways to find the pathways to a sustainable future.

Reuse Pathways to Action

Classroom and Office Paper Reuse Campaign 118

Used Clothing Drive and Swap 119

Magazine Reuse Campaign 120

Trash-to-Art Project and Festival 121

Success Story

The students at the Martel School in Lewiston stretched their imaginations in the spring of 1991 as they turned their trash into art! These kids, in kindergarten through sixth grades, had free reign to design any kind of project, as long as it was made from clean "used materials." Some students worked with a partner or in teams, others worked alone. Kindergarten classes and some first graders worked on projects in school, but most made their creations at home and brought them to school for the big Art Show. There were collages, pictures, paintings, models, sculptures, even a robot made from milk cartons! The judges, invited from other schools an city hall, were amazed at the variety.

Students had fun searching for just the right kind of trash, and it was challenging for them to turn their ideas into reality. But the project did more, it reached into the homes of the city. Trash-to-Art prompted clean-up projects at home. Parents, grandparents, brothers, and sisters all got the message that their trash could be useful. They began looking for other ways to use their throw-aways. Many began to think that they were throwing away too much in the first place. These are the messages that Mrs. Vaughan, Miss Fairweather, and the Save the Planet Committee wanted to spread when they first proposed the idea to the staff. In addition to the Art Show, the committee received an Eisenhower grant to buy environmental books and videos for the library. This is a project that will be with the Martel School for many years!

Classroom and Office Paper Reuse Campaign

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Project Length
2 class periods

Related Activities
- *Drop in the Bucket*
- *How Much Trash?*
- *Bread and Kisses*
- *Everyday Choices for a Sustainable Future*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview

Students identify sources of paper waste in the classroom, office, and teacher's room; then they develop strategies to reuse usable paper.

Background

Paper is usually one of the largest budget items for "consumable" materials. While there are many school activities that require paper, a great deal of paper often gets wasted. By reusing paper with useful surfaces, and by using it for other purposes, the school will save money as well as reduce solid waste.

See the background information section on Reuse.

Planning Considerations

1. Get budget figures from the principal to document how much paper is purchased each year. Have students calculate the average paper use for each classroom; each student.
2. The focus of this action project is on *reuse*, but you will find that there is a lot of paper that can't be reused, but could be recycled. You may want to combine this project with planning a paper recycling program.

Suggestions for a Successful Campaign

1. Inventory the amount of paper thrown away in the classroom, office, teacher's room, and other locations where paper is used or copied. Include all types of paper besides books (worksheets, handouts, notebook paper, drawing paper, newspapers , magazines, tests. Separate out the paper that could be more completely used in some way before being thrown out. How much money could be saved by reusing that paper? Set a goal for how much paper can be saved (by your class; by the office; etc.) for the rest of the school year.
2. Brainstorm with students to generate ideas about how paper can be reused. Their ideas will most likely include: making double sided copies, using the backs of paper for drawings or practice work, making note pads from partially used paper.
3. Discuss ways to inform others in the school about saving reusable paper and how they can use paper more completely.
4. Prepare "publicity" for reminding other students and teachers about the reuse campaign and how they can help (separating, not crumpling, etc.)
5. Set up collection boxes in the various locations so you can collect the paper separately from other trash. You might leave notices about which types of paper you want to collect for reuse. Other bins might be set up at the same time for paper recycling. Work out a collection schedule and assign responsibility for collecting paper from the boxes.
6. Use one or more class activity periods for "processing" the reusable paper.
7. Discuss ways to keep the reuse campaign as an on-going project

Follow-Up

- Calculate the amount of paper saved, and the value of that paper.
- Propose that the money saved by not buying paper be transferred in the budget to other student-related projects or to a student/faculty controlled fund. (The Windham Jr. High School Student Environment Committee takes revenues from their recycling program and administers a mini-grant program for teacher projects.)
- Discuss ways to convince the school administration to purchase recycled paper or paper with higher post-consumer content (see the "Buy-recycled campaign" action project.) The money saved by reusing paper could be allocated to the slightly higher cost of recycled paper.

Used Clothing Drive and Swap

Overview

Students and their families collect clothing that is no longer useful to them and 1) make it available to other families at a yard sale-type "swap" and 2) give the leftover items to a local charity for use or sale. This is an effective one-time event or can develop into an annual tradition.

Level

● **Introductory**

■ **Intermediate**

◆ **Advanced**

Project Length

2 class periods and a swap day (after school or Saturday)

Related Activities

- *Drop in the Bucket*
- *How Much Trash!*
- *If Toys Could Talk*
- *Bread and Kisses*
- *Home Waste Audit*
- *Local Waste Management Options*

Background

Textiles comprised 1.7% (by weight) of Municipal Solid Waste in Maine in 1991. Although this seems like a very small amount, 1.7% represents 21,250 tons of cloth! This figure does not include industrial textile waste or non-baggable cloth in MSW. In Maine, used cloth is collected and processed by the Salvation Army and Goodwill Industries as well as many thrift stores and second hand stores. Clothing that is too worn out is cut into rags by the big processors and sold as rags.

See the Background Information section on Reuse and Recycling Market and Resource Directory, section on Clothing and Textiles (Maine Waste Management Agency publication listed in Resources).

Planning Considerations

1. This project will have the biggest impact if families from the entire school participate (although a single class can collect a significant volume.) It is energy intensive and parent volunteers will be very helpful, although intermediate and advanced students can do a lot of the work. If a smaller event is planned, the swap can be held during or after school in a less formal way.
2. Publicity and organization will be the biggest factors for success. Give enough notice so families can go through closets to collect items to donate to the clothes drive.
3. Make provisions for collection and storage of the items before the "swap." Ask to have "swappable" clothing marked for size and separated from rag material.
4. Often, churches or social service organizations have collection drives. You might be able to coordinate two drives. Share responsibilities and improve the results!
5. Contact local charities to get a commitment to accept all clothing left over from the swap.
6. Consider other items to be collected and swapped. For example, toys can be cleaned and traded. Games and books can be donated to local hospitals and libraries.

Suggestions for a Successful Drive

1. Have the class decide how large a project they want to take on (the class, the grade, the school.)
2. Generate ideas for:
   - informing families and other students about collection and the swap
   - creating publicity
   - date and location of swap
   - managing materials collected
3. Divide responsibilities for publicity, collection, storage, sorting, transport of materials.
4. Enlist parent volunteers to help organize items for the swap and/or to help supervise students.
5. Keep a tally of the number of items donated, and the number of items traded away as a measure of the impact of the swap. Alternatively, you could weigh the donations before and after the swap.

Follow-Up

- Make and display a chart from the data to inform the school about the success of the project.
- Write a short report describing the project and send it to the Maine Waste Management Agency.
- Write an article for the local newspaper describing the project and the results.
- Write letters of thanks to all volunteers who helped with the project.

Magazine Reuse Campaign

Level
- ● **Introductory**
- ■ **Intermediate**
- ◆ **Advanced**

Project Length
2 class periods
on-going collection and delivery

Related Activities
- *Drop in the Bucket*
- *How Much Trash?*
- *Bread and Kisses*
- *Home Waste Audit*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview

Students develop a system to collect and redistribute magazines to friends, Laundromats, waiting rooms, and other public places where they can be read by other children and adults.

Background

Anyone who subscribes to a magazine quickly learns how fast old magazines accumulate. Many of these magazines can be donated and used by others. If they know a regular supply of not-too-outdated magazines is available, professionals who have waiting room subscriptions may be able to cancel a subscription and save natural resources.

Planning Considerations

1. Inform parents about the project and ask for their help in delivering magazines on a regular basis to one or two locations each.
2. Consider donating magazines to a Laundromat, any health care or other office waiting room, hospital, school home economics or child care classroom, or any other public place. Students may find they can share magazines among themselves.
3. If a commitment is made to provide magazines regularly, set up a schedule for collection and distribution that will not be too much of a burden on any single person.
4. If possible arrange to collect worn and unneeded magazines back from the locations and get them to a magazine recycling facility.

Suggestions for a Successful

Campaign

1. Survey the class (and the school) to create a list of magazines that might be available for donation.
2. Compose a letter of request with a response form, and distribute it to all the possible sources of magazines. Keep track of the responses in a list or in a simple computer database.
3. Begin collecting the magazines right away. Store them in boxes by magazine-type.
4. Brainstorm a list of public places where magazines could be enjoyed by people who need to wait, or who could benefit from any particular type of magazine.
5. Divide responsibilities for contacting those places to see 1) if they are interested in receiving magazines and 2) which magazines (of the ones you will have available) they would like to have.
6. Match the magazines available to the types requested and begin delivering as soon as possible.
7. Establish a schedule for regular collection and delivery of the magazines. Give students as much responsibility for this process as possible.

Follow-Up

- Maintain the magazine collection schedule and check with the students, their parents, and delivery locations regularly to provide support.
- Write an article for the local newspaper describing the project. Have a recipient of the magazines write a letter to the editor.
- Organize a magazine recycling collection program at the school and transport unneeded magazines to the recycling center.

Trash-to-Art Festival

Overview

This is a class- or school-wide activity where students gather materials that are being thrown away to create unique "art" projects. With few rules or limitations, students are asked to gather materials and do the construction at home then bring their creations to school for a festival to be displayed. Prizes are awarded.

Level

● **Introductory**

■ **Intermediate**

Project Length

1-2 weeks

- **one class period (introduction and brainstorming)**
- **1-2 weeks working time (may involve class time for younger students)**
- **items on display for a day or two**

Related Activities

- *Drop in the Bucket*
- *How Much Trash!*
- *Mounting Milk Cartons*
- *If Toys Could Talk*
- *Bread and Kisses*
- *For Better or Worse*
- *Are Ten Better Than One!*
- *Where'd You Get That Can!*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Background

Many household throw-aways are reusable:

- glass jars to store food and small items
- paper and plastic bags for storage and shopping
- washable plastic dinnerware
- plastic containers for storing leftovers and for freezing foods
- washable aluminum pie tins
- polystyrene packing peanuts for mailing your own packages

However, there are items that eventually must be discarded. This activity is a final attempt to make "valuable" use of some of those items. Possibilities for trash-to-art projects include collage, masks from plastic jugs, flower post, bird feeders, sculptures, robots, or 3-D models. The list is limited only by students' imagination!

See: Background information on Reuse, Ranger Rick magazine Sept. 1990 (egg carton critters) and other issues.

Planning Considerations

1. Items of "trash" must be clean.
2. Arrange to have judges from the administration or from outside the school.
3. Give students enough time to complete the projects at home, but not too long. One or two weeks is a reasonable time frame and avoids having projects create clutter.
4. Younger students or special groups may benefit from constructing projects in-school.
5. Arrange for the dismantling and recycling of as many of the components as possible. Students should plan to take their projects home if they can't be recycled. It would be counter-productive if the projects were left at school for the custodian to throw in the dumpster!
6. Communicate with parents about the projects so they can get involved. Send home information about recyclables, reusables, and waste reduction to get the families involved with waste reduction.

Suggestions for a Successful Festival

1. The basic rule: Each project must use only items that would be thrown out. You might bend this rule by saying that glue or other "non-trash" fasteners are acceptable. Projects can be two-dimensional (like a painting or collage) or three-dimensional "sculptures" or models. They should be stable enough to be transported to school.
2. Provide a few examples to get the students motivated. A lead class could make a few items in school from school trash (like milk cartons!) to spark the imagination of other students.
3. Have students work in pairs or small teams. Some students may choose to work independently.
4. Have students describe their progress (progress reports or drawings) part way through. They may be able to share ideas or encourage those who are having a hard time.
5. Establish categories upon which the projects will be judged: Creativity, most recyclable, best working model, neatest,

Trash-to-Art Festival

etc. There can be any number of fun or made-up categories to include as many winners as you like!

6. On the day of the festival, include other displays to teach about waste reduction, reuse, or recycling. Have students bring in redeemable cans and bottles as a fund-raiser.
7. Have the operator or your transfer station or a waste hauler present the awards.

Follow-Up

- Brainstorm ways to dismantle or recycle the projects.
- Use the enthusiasm from the festival to kick off other action projects or fundraising activities.

Recycling Projects
3 in the Waste Management Hierarchy

Over the past several years, most enthusiasm for dealing with waste problems has gone into recycling. A teacher, or a small group of students gets concerned about trash, starts a program to collect recyclables and has some success reducing the amount of trash they throw out. The challenge is to get everyone involved and to share the work so it doesn't fall to just one or two committed people.

Starting a recycling program is important. But just as important, is developing the awareness and commitment to reduce waste and make recycling work in the long run. The school is a great place to start, and with the whole school community's participation recycling can really change the way the everyone thinks about waste.

Recycling Pathways to Action

School Recycling Program 124

"Buy Recycled" Campaign 126

Home Recyclables Collection Center 130

Success Story

Third graders at the W.G. Mallett School in Farmington are learning their "3 R's for the 90's." In the fall of 1992, teachers Sylvia Yeaton and Cheryl Pike began their innovative program to use recycling as the theme to promote cooperative learning and an integrated curriculum. With a $1000 grant from International Paper Co. and parent and college student volunteers, Ms. Yeaton and Ms. Pike started the 3 R's program which got all Mallett students and teachers to reduce, reuse, and recycle.

Students formed six committees: Newsletter publishers, data collectors and display, educators, photographers, collection supervisors, and recycling club organizers. They worked during Friday afternoon activity periods, and each student made an important contribution to the effort. The students took real responsibility to teach others about the recycling process, to keep classes informed about how well they were doing, to supervise and encourage student collectors, and to work on special projects like Christmas tree chipping and publicizing special events These third graders were the engine that kept the program running through the school year.

The recycling program ran smoothly throughout the year until the committees were taken over by new third graders in the fall. The younger students saw how much fun the last year's third grade had and were eager to try it themselves!

School Recycling Program

Level
- ● Introductory
- ■ Intermediate
- ◆ Advanced

Project Length
5-10 class periods for set-up

on-going efforts will be required through the school year

Related Activities
- *Drop in the Bucket*
- *How Much Trash!*
- *Mounting Milk Cartons*
- *If Toys Could Talk*
- *Bread and Kisses*
- *Where'd You Get That Can!*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview

Setting up a recycling program is one of the most common, and most energy-intensive waste management action projects initiated in schools. Much of the preparation for developing a recycling program, however, may already be complete from other activities in Pathways to a Sustainable Future. *Developing student awareness, conducting a waste audit, and identifying the path waste takes in your community provide a solid footing for setting up a recycling program.*

There are many different options for starting a program at your school. Any materials that are accepted for recycling by your hauler or local recycling center can be included in the program. Depending on the scope of your program, you could separate and recycle only one or several different materials (office paper, newspaper, aluminum, glass, steel or tin cans, magazines, plastic, and/or redeemable cans and bottles.) You might even earn some money to help support the program by selling recycled materials to brokers.

Background

Remember that recycling is the third priority on the waste management hierarchy. Source reduction and reuse strategies should be developed in addition to collecting materials for recycling. However, by establishing a recycling program in school, students and teachers become more sensitive to creating less waste and conserving resources.

References

Background information section on recycling

Office Paper Recycling Guide (Maine Waste Management Agency, 1990)

Waste Management Services Directory (Maine Waste Management Agency, 1993)

Set Up a School Recycling Program (Maine Waste Management Agency Fact Sheet)

Model graphics for Developing Recycling Promotional Materials (clip art for flyers and posters, Maine Waste Management Agency)

Planning Considerations

1. The school-wide recycling program is a major undertaking and will need the support of students, teachers, the administration, food service personnel, custodians, waste haulers, the recycling center staff, and/or brokers. A faculty advisor should be identified to provide continuity between all segments of the program.
2. Establish the lead class, a recycling committee, or an environmental club with a faculty advisor to help coordinate the recycling program and to promote it throughout the year.
3. It is often better to start out small by collecting only one or two materials. Expand the program later, when procedures are running smoothly and participants are familiar with the program.
4. Create a budget for the program. Consider expenses like collection bins and hauling fees. Research possible revenue from selling recyclables or cost savings from reduced disposal fees.

5. Use information from your school waste audit to anticipate the volume and types of materials you will be collecting.
6. Use information from your investigation of local waste disposal practices (Local Waste Management Options Flow Chart), the Waste Management Services Directory, and other resources to identify haulers, brokers, markets, and regional recycling facilities.

Suggestions for a Successful Program

1. Have the recycling committee decide on the scope of the program. Consider starting with paper, especially if it is the recyclable item with the largest volume in your waste stream.
2. Divide responsibilities for any necessary research. Think through the mechanics of collecting and recycling the materials.

Find a market

3. Who will take your recyclables? Find out if your current waste hauler offers recycling services. Is there a separate broker that will accept your materials? What does the local recycling program accept? Decide which is the most convenient and lowest cost option.
4. Determine how the materials must be gathered and prepared for the recycler or broker. Exactly what is acceptable (what types of material, crushed or not crushed, bundled or not, etc.) and what is the minimum amount required for a load?
5. How will the material be delivered to the processor? What are the delivery costs?

Determine space, container, and equipment needs

6. How will you store the material? How much will need to be stored between pick-ups? Do new facilities need to be built? Where? How? Is there a no-cost solution?
7. Will the recycler provide containers? Will you need to make containers yourself? The collection bins should be
   - the same throughout the school,
   - colorful and different from regular trash containers,
   - clearly marked for the type of material being collected.
8. Storage areas should be convenient and clearly marked for pick-up. They must comply with safety codes.

Educate participants and promote the program.

9. Provide clear, accurate information. Plan the educational campaign so people will know
   - what you want them to do,
   - how you want them to do it,
   - what they will accomplish by doing it.
10. Prepare promotional and informational materials. Develop ideas with the students which may include notices, a poster contest, in-class demonstrations. Have students teach students and make the presentations when possible.
11. Present a skit or other formal kick-off event for the whole school

Plan for on-going maintenance of the program.

12. With the recycling committee and other interested students, create a work schedule that divides responsibilities over time so enthusiasm can be maintained.
13. Monitor proper use of the containers, oversee on-going promotion, provide feedback to encourage participants.

Follow-Up

- Evaluate the program. Keep records to chart the program's effectiveness. How much are you recycling? Does this match your expectations? Make suggestions to the committee.
- Do a follow-up audit at least once annually to measure the effectiveness of the program.
- Have local media cover the success of the project. Get as much publicity as possible. Continue to promote the program using the data gathered.
- At the end of the year plan a ceremony to transfer responsibility for managing the recycling program to an upcoming grade.
- Recruit new members for the recycling committee and plan on recharging the program each fall by *re*starting the committee, *re*teaching participants, and promoting the program with new energy.

"Buy Recycled" Campaign

Level
- ● **Introductory**
- ■ **Intermediate**

Project Length
1 class introduction
about one project-week for research
2-3 class periods to prepare the campaign

Related Activities
- *Drop in the Bucket*
- *How Much Trash!*
- *Bread and Kisses*
- *Everyday Choices for a Sustainable Future*
- *For Better or Worse*
- *Are Ten Better Than One!*
- *Paper, Plastic, or Cloth!*
- *Where'd You Get That Can!*
- *Test the Alternatives*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*

Overview

Students initiate an awareness campaign to encourage school officials to buy products with recycled content for use in the school. They also identify products with recycled content and retail sources of these products, then encourage their families and the community to buy recycled content products rather than products without recycled content.

Background

The 1993 Maine state recycling plan includes a call for developing consumer education programs in cooperation with retailers and manufacturers, promoting the national "buy recycled" program for Maine businesses, and increasing state and local procurement of products with recycled content. These programs are designed to promote markets for recycled products and ultimately to help change consumer habits which will allow recycling to become a self-sustaining enterprise. Yet, there is much work that needs to be done to educate consumers, retailers, and manufacturers about the essential elements of recycling.

The recycling logo contains three chasing arrows. Each arrow represents an element of the recycling process:

1. **Collecting** materials that otherwise would be thrown away,
2. **Manufacturing** new products using those materials, and
3. **Purchasing** the new products.

Recycling is not complete until the materials collected are turned into new products and those products are then purchased again by consumers. All three steps are necessary to "close the loop." For recycling to succeed, consumers must buy recycled content products and let the retailers and manufacturers know that they want products with recycled content. In addition, schools have significant buying power and can influence markets by "buying recycled."

Consumers should understand the meaning of the terms used in recycling so they can make informed purchasing decisions. Although manufacturers and government agencies are not necessarily consistent with definitions, the Federal Trade Commission and the EPA are making efforts to standardize the terms. The Maine Waste Management Agency uses the following definitions in when referring to products with recycled content:

- **Recycled** refers to a product which contains *some* recovered materials.
- **Recovered materials** include both preconsumer and postconsumer materials.
- **Postconsumer materials** come only from products which have served their intended end uses; they are materials that have been collected in office, commercial, and residential recycling programs; otherwise they would have been discarded in the waste stream.
- **Preconsumer material** refers to any material generated in the manufacturing process. This does not include any waste material that can be reused or that has been normally reused in the original manufacturing process, and would not normally have entered the waste stream.

The only way for consumers to encourage markets for recycled materials is by purchasing products with postconsumer materials. The Buy Recycled Business Alliance, a campaign of the National Recycling Coalition, which promotes the purchase of recycled content products by businesses, has identified several important issues to guide consumers of recycled

products. School officials and consumers considering "buying recycled" (and students encouraging them to "buy recycled") should examine these issues to help them develop an effective campaign.

- **The scope of products available.** Recycled paper is the most common, but is not the only recycled product. Products with recycled content are available for almost any type of material. Refer to the Official Recycled Products Guide or the Recycled Products Information Clearinghouse (see References and Contacts.)
- **Product quality and performance.** Ask manufacturers and vendors about quality. High quality products with recycled content are available, and consumers do not need to accept inferior quality or performance.
- **Product availability.** Since they are often manufactured by small companies which don't keep large inventories, recycled products may not be as readily available as other products. Check the lead time and availability of various products.
- **Types and percentages of recovered materials**. Have the vendor specify how much preconsumer and how much postconsumer material is used in each product and base your purchasing decisions on the amount and source of recycled content.
- **Product cost.** Many people think that recycled products cost more than products without recycled content. *This is often not the case,* recycled products can cost less than, or the same as products with no recycled content. In some cases products do cost more because of economy of scale. As the demand for recycled products increases, manufacturers will be able to produce those products more efficiently, and the cost will decrease accordingly. For this very reason, it is important to support "buy recycled" efforts!

Examples of Products with Recycled Content Currently Available

Paper Products

Adding machine tape
Construction paper
Copier paper
Corrugated and paperboard boxes
Food service bowls and trays (molded pulp)
Newsprint
Office supplies
- ***Calendars***
- ***Envelopes and mailers***
- ***Fax paper***
- ***File folders***
- ***Labels***
- ***Post-It notes***
- ***Writing tablets***

Poster board
Storage boxes
Tissue and towel products

Transportation Products

Anti-freeze
Re-refined engine oils
Retread tires

Plastic Products

Bags
Boxes, bins, containers
Food service trays
Lumber
Mats
Office supplies
- ***Desk sets***
- ***Highlighters and markers***
- ***Pens and pencils***
- ***Recharged toner cartridges***

Picnic tables and benches

Rubber Products

Bulletin boards
Floor tiles and mats
Playground equipment and surfacing
Portable bases and walkways
Speed bumps
Also many Construction Materials; Aluminum, Steel and Glass Products

Sources of Recycled Products: The Buy Recycled Business Alliance "Buy Recycled Guide" and The Official Recycled Products Guide, Recycled Products Information Clearinghouse.

School districts (SAD or School Unions) are eligible to buy recycled and remanufactured products through state contracts or the state storeroom. Because of the large volume purchases, the contract state prices are often lower than prices available for smaller quantities. Products such as the following are available to municipalities and school districts.

Copier paper
Envelopes
Toilet tissue
Re-refined oil
Plastic lumber
Computer paper
Paper towels
Plastic trash bag liners
Retread tires

Public organizations interested in purchasing these or other available products should contact the State Bureau of Purchases (289-3521) or refer to the pamphlet "Buying Recycled Through Maine State Government" (reference below.)

Much of the recent increase in the use of recovered materials for consumer products is a result of the demand for recycled content products by consumer, government, and corporate purchasers. Manufacturers need to know that you demand high quality products made with recycled content. It may be unrealistic to expect 100% recycled content in all products because of quality or manufacturing requirements. Still, the goal is to "close the loop" by encouraging markets for recovered materials. This will help reduce the waste stream and it will help conserve natural resources.

References and Contacts

Background information section on recycling.

Buy Recycled Campaign, U.S. Conference of Mayors, 1620 I Street, NW, Washington, DC, 20006, (202) 293 7330. Portfolio on establishing a "buy recycled" program, including a model ordinance.

Buy Recycled Guide, National Recycling Coalition, Buy Recycled Business Alliance, 1101 30th Street, NW, Suite 305, Washington, DC, 20007, (202) 625-6406.

Buying Recycled Through Maine State Government (Maine Waste Management Agency and Maine Dept. of Administration Bureau of Purchases.) Pamphlet describing products and assistance available to school districts, state agencies, and local governments through the state purchasing agent.

Model graphics for Developing Recycling Promotional Materials (clip art for flyers and bin labels, Maine Waste Management Agency.)

Recycled Products Information Clearinghouse, CERMA, 5525 Hempstead Way, Springfield, VA, 22151, (703) 941-4452. Information about recycled products, guidelines, "buy recycled" programs, product specifications.

Seventh Generation Inc., Colchester, VT, 05446, (800) 456-1177. Retail catalog of "products for a healthy planet" including products made from recycled materials.

State of Maine Waste Management and Recycling Plan, April 1993 (Maine Waste Management Agency.)

The Natural Connection, P.O. Box 8233, North Brattleboro, VT, 05304, (802) 365-7188. Directory of manufacturers of eco-friendly products.

The Official Recycled Products Guide, American Recycling Market, Inc. P.O. Box 577, Ogdensburg, NY, 13669 (800) 267-0707. Monthly newsletter, on-line database subscription to directory of manufacturers and vendors.

Planning Considerations

1. An effective "buy recycled" campaign in any organization requires a commitment from the administrators who actually approve purchases. After having students do some basic research to identify the issues and understand some of the recycled products available, have the students involve the administrators in the process of understanding the importance of "buying recycled." Get a commitment from the administrators to buy recycled products and to take the students' recommendations seriously.
2. "Buy recycled" efforts can be important in schools which do not yet consider recycled content in purchases and in schools that already purchase some products with recycled content. For schools already "buying recycled", additional progress can be made by increasing the percentage of recycled content, especially postconsumer material.

Suggestions for a Successful Campaign

School "Buy Recycled" Campaign

1. Present background about the benefits and the need for "buying recycled" and help students develop a presentation to the administration.
2. Evaluate current school purchases for opportunities to "buy recycled." Use information from your school waste audit to identify high priority items in the waste stream where the recycled content (the purchasing side of the loop) can be increased in future purchases.

3. Work with the principal, office staff, academic department heads, food service director, and maintenance supervisor to identify regular purchases and upcoming special purchases. Then identify possible products with recycled content that will meet the school needs. (The school department may have written specifications for various items which preclude recycled content; discuss the real needs those specifications are meant to serve and explore adjusting them based on new developments in recycling technology.)
4. Investigate the possibility of purchasing certain supplies through the state Bureau of Purchases (see "Buying Recycled Through Maine State Government" noted in the references above.)
5. Research available products with recycled content. Have students gather information from current vendors (most have toll-free 800 numbers), sources listed in the references above, and retailers. Inquire about the recycled content, quality, availability, and price of products. Match this information to the lists of products purchased by the school.
6. Present the information to the school administrators and others who make purchasing decisions. Work to get their commitment to purchase recycled products. This may take additional presentations and appeals to the school board. The more you can educate the decision makers, the more effective the campaign will be!
7. Offer to work with the purchasers to discuss options with vendors, and encourage them to challenge the vendors to provide the needed items with a higher percentage of recycled content in an acceptable price range. Be prepared to approach other suppliers if the price or quality does not compare well with previously purchased products. This process emphasizes your sincerity and will influence suppliers to provide the products consumers demand.
8. When purchases are made, inform the school community about the items, the recycled content, and the impact of the purchase on the waste stream.
9. Be sure products that are purchased meet the users' expectations for quality. Test items against the non-recycled material if there is any doubt. Provide feedback to the suppliers and manufacturers.

Home and Community "Buy Recycled" Campaign

1. Research available consumer products with recycled content. Brainstorm items with which students are familiar; refer to catalogs and sources listed above; tour supermarkets or other retail stores and discuss recycled content with the store managers and purchasers. Look at packaging as well as the products.
2. Plan effective ways to get information to families and others in the community to convince them to buy recycled products.
   - Get the approval of store mangers to put up information displays in the stores, identify specific products in the store which have recycled content.
   - Develop informational flyers or a poster campaign which identifies the reasons we should "buy recycled," identify popular products with recycled content, and locations in your community where consumers can find them.
   - Present information at public meetings (civic groups, Chamber of Commerce) to inform a wider public audience.
3. Develop a strategy to get students, families, and the public to inform retailers and manufacturers that they prefer products that have recycled content or higher percentages of recycled content. Provide enough background information and encourage people to talk directly with the store managers and to write letters directed at manufacturers of popular products.

Follow-Up

- Set up a record keeping system to track the purchase of products and to chart the school's impact on encouraging vendors to supply products with recycled content.
- Discuss the replies from letters to manufacturers. Evaluate the objectivity of the information they provide about the product. Write follow-up letters to reemphasize the need to "close the loop" by manufacturing items with recycled content.
- Design a method to encourage the continued purchase of recycled products. Records that prove cost effectiveness and continued publicity will help keep the issue in the spotlight.

Pathways to Action
Recycling

Home Recyclables Collection Center

Level
■ **Intermediate**
◆ **Advanced**

Project Length
1 class introduction
about one project-week at home
1 follow-up class

Related Activities
- *Drop in the Bucket*
- *How Much Trash!*
- *If Toys Could Talk*
- *Bread and Kisses*
- *For Better or Worse*
- *Are Ten Better Than One!*
- *Paper, Plastic, or Cloth?*
- *Where'd You Get That Can?*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Home Waste Audit*
- *Local Waste Management Options*
- *Trash Sorting Relay Race*

Overview

Students design collection centers for recyclables in class and "construct" a center at home. Students are encouraged to use free or inexpensive materials, and to make plans that use available space in the home.

Background

After students learn about the amount of trash they and their families generate, they are usually compelled to take action steps to reduce waste. After strategies are developed to reduce and reuse waste (preferred to recycling on the waste management hierarchy) families need support in their recycling efforts. Getting information about recycling opportunities in the community is the first step, and setting up the process for collecting the recyclables is the next step. If curbside pick-up is not available, families may also need help support (and encouragement) getting the materials to the recycling center.

References

Background information section on recycling

Municipal Recycling Programs in Maine (Maine Waste Management Agency)

Model graphics for Developing Recycling Promotional Materials (clip art for flyers and bin labels, Maine Waste Management Agency)

Planning Considerations

1. Complete the home waste audit and local waste management options chart to get the information needed to design the collection center.
2. Communicate with parents about the upcoming project and how they can be involved. Encourage them to have the students do most of the planning and work, if possible.
3. Be sure families know how recyclables should be prepared before taking them in to the recycling center (bundling, remove labels and caps, etc.)
4. If some families already have collection centers, those students can offer experience in the planning and team up with others who might need help.

Suggestions for Successful Projects

1. Use students' home waste audits to make a list of recyclable materials they produce at home. Compare the list to materials that are accepted for recycling at the local or regional recycling facility.
2. Discuss how much space would be needed for each type of recyclable, and the types of containers that would be appropriate. Keep in mind that the more often materials are taken to the recycling facility, the less storage space will be needed.

3. Have students draw a rough floor plan of their kitchen and other areas of the home which might be used for storing recyclables. Then locate the collection bins on the floor plan. One of the biggest difficulties is to locate the recycling center conveniently to the kitchen (where most of the recyclables are) without creating clutter or an eyesore. Some possibilities are in a closet, corner of the kitchen, under the sink, in the garage or basement. Many families will need to have the center covered or enclosed.
4. Brainstorm ideas for collection bins and designs for constructing them. Consider simple boxes, additional waste baskets, plastic bags supported by wood or plastic pipe frame, or even paper bags. Different materials could call for different storage method. For example, thread a piece of light rope through the handles of plastic milk jugs and hang them up out of the way. In the designs students should consider cost, appearance, and ease of construction.
5. Make drawings of the different ideas. Students then take the drawings and their floor plan home to discuss with the family. The family should work out their plan for locating and constructing the center, and for transporting the materials to the recycling facility.
6. Make labels for the storage bins.
7. Give the students about a week to build the collection center. Have them bring in a photo or drawing of the completed project.
8. When most projects are complete, share pictures in class and discuss the process. Discuss problems that came up and how they were solved.

Follow-Up

- Students can keep a chart of the amount of recyclables (weight, number of trips) they take to the recycling facility. Set a class goal and record the progress on a thermometer-type graph.
- Make a bulletin board showing the completed projects and encourage other students to build their own.

Composting Projects
4 in the Waste Management Hierarchy

Composting is a decomposition process which can convert any organic waste into a useful product. It can completely divert organic wastes from the waste stream. These wastes can be composted wherever there is space for a composting bin. When it is done on by individuals or schools, it is much less expensive than municipal disposal by incineration or landfilling. The county Cooperative Extension offices are a valuable resource and have materials and expertise to help with all local composting projects.

Composting Pathways to Action

Classroom Worm Bin Project 134

Cafeteria Food Wastes Composting Project 137

Plans for Constructing Composting Bins 140

Success Story

Cafeteria waste from the Wiscasset Primary and Middle Schools never gets to the transfer station or the landfill. Since 1991, the garbage, leftover milk, paper milk cartons, and napkins have gone to a local farm and been composted.

Woody Freeman, the school transportation supervisor, began planning the system-wide program in 1990. With the support of the Lincoln County Compost Committee, he received approval from the school committee, a budget of $2200, and environmental approval from the Maine DEP. Then he rented the equipment, educated the students, teachers, and maintenance staff, and made arrangements at the Morris farm. Wiscasset began composting in the spring. Since the beginning of the program, it is estimated that 700 cubic yards of garbage have been converted into 35 cubic yards of compost, some of which has been used in planting projects at the schools and the Morris Farm. Not only is it good for the environment, it has saved the town of Wiscasset hundreds of dollars on tipping fees and much more than that on labor and transportation costs.

Mona Schlein, a teacher at the Wiscasset Primary School, started composting with her kindergarten students right at the school. Now, in the school courtyard a three bin composter, a barrel composter, and an aerated cone composter all break down food wastes from classroom snacks. There is also a worm farm that students in many different classrooms care for. These projects give students hands-on experience with composting and they use the finished compost for spring planting projects.

The Lincoln County Compost Committee includes representatives from the University of Maine Cooperative Extension, Maine Dept. of Agriculture, Maine Dept. of Environmental Protection, Maine Waste management Agency, Soil Conservation Service, and Lincoln County Recycling.

Pathways to Action
Composting

Classroom Worm Bin Project

Level
● Introductory
■ Intermediate

Project Length
2-5 periods to set up the bin
ongoing through the school year

Materials
worm bin or lumber for bin construction
redworms (minimum 1000, or one pound)
black plastic bag or sheet
two handfuls of soil
scale
bedding material (newspaper recommended)
water
food wastes

Related Activities
- *Drop in the Bucket*
- *How Much Trash!*
- *Bread and Kisses*
- *Getting to the Route of the Hazardous Waste Problem*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*

Overview

In this action project, students and teachers set up a working worm bin to compost food wastes in the classroom. The product is a type of compost that is an excellent soil conditioner and fertilizer which can be used for classroom projects or taken home for use in gardens.

References

See the background information section on Composting
Strongly recommended: Worms *Eat My Garbage* by Mary Appelhof, 1982: Flower Press; Kalamazoo, Michigan.
Composting with Worms (Maine Waste Management Agency Fact Sheet)

Mail order sources of redworms, containers, and bedding material:

Earthworm Environmental Services
R.R. #1
Haley Station, Ontario CANADA
K0J 140
(613) 432-9699

Flowerfield Enterprises
10332 Shaver Road
Kalamazoo MI 49002
(616) 327-0108

Beaver River Associates, Inc.
P.O. Box 94
W. Kingston, RI 02892
(401) 782-8747

The Earthworm Company
3675 Caistoga Rd.
Santa Rosa, CA 95404

Carter Worm Farm
Plains, GA 31780
(912) 824-7707

Gardener's Supply Co.
128 Intervale Rd.
Burlington, VT 05010
(802) 863-1700

The Philadelphia Worm Co.
P.O. Box 9586
Philadelphia, PA 19124
(215) 744-2349

Planning Considerations

1. Setting up and maintaining a worm bin is not difficult. There are, however, certain guidelines that must be followed to keep the worms healthy and the system vital. Mary Appelhof's short book, *Worms Eat My Garbage* is an excellent guide to setting up a robust worm composting system. Consult this book before starting a project!
2. Funds for the purchase of worms or a worm bin may be available to teachers through the school district.
3. There are three major ingredients are necessary to start a worm composting bin. All can be acquired through mail order services such as those listed.

   Container If you decide not to purchase a bin, the following guidelines may be helpful:

   The container for the worm bin can be built easily out of plywood or scrap lumber. Large plastic containers and steel washtubs will also work. Consider that the size of the bin should be related to the amount of food wastes that will be composted. (Note: Constructing the bin

will not be a good classroom activity. Arrange to have this completed in advance so that classroom time can be spent on the other steps.)

Depth: The worm bedding should never be more than eight to twelve inches deep, so the bin does not need to be more than sixteen inches deep.

Length and width: In general, *one square foot of surface area will be necessary for each pound of waste that will be added during the course of a week.* (Thus, if one pound of waste is added each day at school, approximately five square feet of surface area are needed for the worm bin. A two-foot by three-foot bin should suffice in this case.) Before acquiring a bin, in order to insure the correct size, estimate or weigh the food wastes that the classroom produces each week.

Air holes: No matter what your bin looks like, it will need several nickel-sized holes in the bottom for aeration and drainage. These holes will help to keep the worms healthy and the compost odor-free. (To minimize leakage, consider placing a screen or a sheet of nylon mesh inside the bin on the bottom.) A solid lid may be convenient, but it should not be air-tight.

Bedding Many materials are suitable bedding, including machine-shredded newsprint, hand-shredded newsprint, partially decomposed leaves, peat moss, and manure. For simplicity and cost-effectiveness, fine, hand-shredded newsprint is recommended. *Between 1.5 and 2 pounds of dry bedding are necessary for each square foot of surface area.* (Thus, a two-foot by three-foot box will need between nine and twelve pounds of dry bedding.) Water will be added to this later.

Worms Redworms are the preferred variety of worms for composting, as they will digest food rapidly and reproduce quickly. The number of redworms needed will depend on the amount of waste that is put into the system. In general, *the worms will be able to handle half of their body weight a day in garbage.* (Thus, if you expect one pound of waste a day, two pounds of worms should be purchased.)

4. The worm bin will need to be located in a cool place. It will also need to be in a place where it can get the floor dirty since dirt may leak through the holes in the bottom.

Suggestions for a Successful Project

1. Construct the bin ahead of time. The preparation of the bin for composting, in class, will take about an hour.
2. **Preparing the Bedding:** If newspaper is being used for bedding, it will need to be shredded thoroughly by hand.
   The bedding should have a moisture content of approximately 75% by weight. *This means that for every pound of bedding, the bin will need nearly three pounds of water.* (This sounds like a lot, but remember that a pound of shredded newspaper is a lot of newspaper, and water weighs one pound per pint. Your bedding should be able to absorb all the water. A good test for proper moisture content is to squeeze a handful of the damp bedding. If three or four drops of water come out, the bedding is perfect.)
   It may be easiest to prepare the bedding by adding water a little at a time to the dry bedding in a separate bucket or bag, and then placing it in the worm bin. *Be sure to include two handfuls of soil!* The worms will ingest the soil particles to help them grind up food wastes inside their digestive tracts.
3. **Adding the Worms**: When the bedding is prepared, add the worms to the bin. They will immediately squirm into the bedding to avoid the light. Cover the bin with a sheet of black plastic which has been cut to the size of the bin. You are now ready to add food wastes!
4. **Adding Food Waste**: Most foods can be put into the worm bin. Small or shredded pieces of food waste are best, especially when you first start your worm bin.

Classroom Worm Bin Project

Worms particularly like coffee grounds, tea bags, and banana peelings. Don't put in too much food at first because any uneaten food will rot. Slowly increase the amount and variety of food scraps.

It is a good idea to always avoid meats, which can smell bad during decomposition and bones which can also smell will not be eaten by the worms. Also avoid citrus rinds, onions, tobacco, raw squash, eggshells, and broccoli.

Non-biodegradable items should never be put in the bin, especially wrappers and other packaging.

When food wastes get added, they should be placed under the bedding in an area where foods have not been deposited recently. This will keep the worms moving around the bin and prevent fruit flies from laying eggs in the uncovered food wastes. Always cover the bin again with the plastic sheet to retain moisture.

5. **Maintaining the Worm Bin:** The worm bin needs very little maintenance. The worms will reproduce on their own quite effectively as long as they are getting enough air and food. Every three months or so, however, the compost will need to be harvested. To harvest the dark, nutrient-rich worm castings, push all of the contents of your bin to one side and add fresh bedding material and food to one side and add fresh bedding material and food to the other side of the bin. In a few days the worms will have migrated to the fresh side and you can scoop out the worm castings without getting any worms. Also, leaving the cover off for a short while before harvesting the castings will send the worms to the bottom of the container away from light and you can scoop the castings off the top. The compost can be used directly for planting projects. If the worms are not fed for a period of months, most will die.
Keep an eye on the moisture content of your bin. If water is pooling on the bottom of your worm bin, remove it with a sponge or turkey baster. Excess moisture can kill worms and produce foul odors. Do not place the worm composter in direct sunlight.
6. Rotate the worm bin duties so that all the students get a chance to bury the wastes. Remember to rotate where the wastes are buried!

Follow Up

- Discuss what happens inside the worm bin that turns the food wastes into compost.
- Record how much waste is put into the worm bin each day. Can the class determine when too much waste has been added to the bin?
- Observe the inhabitants of the bin over time. Are there insects who have joined the worms in the bin? (This is nothing to worry about.) How did they get in the bin?

Cafeteria Composting Project

Overview

In this action project, students and teachers initiate and manage a compost pile to process food wastes from the cafeteria. The finished compost can be used for school or home planting projects.

Level

- **Introductory**
- **Intermediate**
- **Advanced**

Project Length

4-8 periods preparation

on-going feeding and maintenance of the pile

Materials

compost bin or lumber for construction (see plans on the following pages and references)

food wastes

containers for food wastes

yard wastes

pitchfork

access to water

Related Activities

- *Drop in the Bucket*
- *How Much Trash?*
- *Mounting Milk Cartons*
- *Bread and Kisses*
- *School Waste Audit*
- *Source Reduction/ Recycling Quiz - Consumer Survey*
- *Local Waste Management Options*

Background

See the background information section on Composting

Backyard Composting by Harmonious Technologies, 1992: Harmonious Press; Ojai, CA.

The Rodale Book of Composting, edited by D. Martin and Grace Gershuny, 1992: Rodale Press.

Composting to Reduce the Waste Stream, Northeast Regional Agricultural Engineering Service Publication No. 43, Cooperative Extension: Itahca, NY, 14853. Available from your county Cooperative Extension office.

Planning Considerations

1. Get approval for this project from school officials before embarking on a composting operation.
2. Plan the project with the input of the maintenance staff. They will probably have some good suggestions and, if they see the benefits of the project, can be one of your best allies in keeping the project running smoothly.
3. Depending on the size of your school, the amount of organic waste that is generated in the cafeteria can be overwhelming. Do not try to set up a program that will compost all organic wastes from the school right away. Plan to compost a few bushels of wastes in the beginning, and increase the volume as you gain expertise.
4. You will need a variety of ingredients and materials for a successful compost pile. They are spelled out below in detail.

Container. This can be built or purchased, but any container will work that:
1) is big enough to allow for substantial heating up (at least 3' X 3' X 3');
2) provides plenty of air to the decomposing materials;
3) can withstand heat and moisture;
4.) cedar wood or recycled plastic is preferable to (toxic) pressure treated lumber.

It will also be helpful to have a container that:
1) is convenient for turning the pile;
2) has a cover to retain moisture (and keep out rainwater);
3) is sturdy enough to keep materials in and animals out;
4) has at least two separate compartments, or use two commercial backyard bins.

If you decide to build a bin, refer to the diagrams for suggestions on compost bin design. Build the compost bin ahead of time, as *this will not be a good class project*.

It is possible to compost in a pit dug out of the ground. This may be the only way to keep composting through the winter.

Compost bins can also be purchased at most hardware stores or nurseries. Specialized compost containers can cost anywhere from $25 to $100 for a small capacity unit (5-20 bushels).

The location of the container can be important to the success of the project. A shady spot that is close to the source of wastes will keep the pile cool in hot weather and make for easy transportation of materials. Discuss possible sites for the compost bin with the class.

Cafeteria Composting Project

The components of compost. A successful compost pile needs four main ingredients. You should keep these in mind as you start and maintain your composting project.

- **Organic wastes high in nitrogen.** Microorganisms use nitrogen to build their bodies. Food scraps, conveniently, contain significant quantities of this element. Other sources of nitrogen include animal manure, fresh green grass clippings, bone meal, and blood meal.
- **Organic wastes high in carbon.** Microorganisms get their energy from complex carbon molecules. Dry leaves are an excellent source of carbon, as well as sawdust, straw, and shredded paper.
- **Moisture.** Water is an important part of a healthy atmosphere for decomposing microbes. Pond water or rain water is preferable to tap water, which may contain chlorine and other additives.
- **Oxygen.** Aerobic microorganisms need oxygen to carry out decomposition. This can be provided by turning the pile with a pitchfork every two or three days. If adequate oxygen is not present, *anaerobic* microorganisms will take over the decomposition process, resulting in foul odors and slower composting.

Decomposing microorganisms. All the bacteria that are necessary for composting are naturally present in the environment, especially in soil. As long as favorable conditions exist in the pile, these bacteria will reproduce rapidly and carry out the composting process.

Organization. Place well-marked receptacles in the cafeteria to collect food wastes only. In a more elaborate project, there might be more receptacles: one for vegetable wastes, one for meat scraps, and one for milk.

Contamination. Be sure plastic and other non-compostable contaminants are removed from the organic wastes. . Train users to separate their waste carefully to avoid having to remove unwanted materials later. Paper is composted in some sophisticated projects, but paper wastes should be shredded before going into the compost pile.

Publicity. Inform the entire school of your composting project. Educate the school community about separating food wastes into the proper receptacles.

Labor. Students and teachers will need to maintain the compost pile, which includes collecting and adding food wastes and the carbon source regularly and turning the pile every few days.

Patience. Composting will take a minimum of six to eight weeks from the completion of the pile until the finished compost has cooled down sufficiently for use. Finished compost can also be stored indefinitely.

5. Analyze the school waste stream ahead of time to determine what items will be the most convenient to compost. You may want to consider some of the following issues in your analysis.

   Initially, it will be easiest to compost vegetable wastes from the cafeteria with leaves, sawdust, and dry grass clippings from the school grounds. Shredded paper (newsprint and notebook paper, for example) can also be used. How much of these wastes does the school produce? Use the results of the School Waste Audit of food wastes. Arrange for the class to interview kitchen workers and maintenance workers.

   If a large project is being undertaken, meat scraps and paper can be considered for composting. How much of these does the school produce?

   How can wastes be efficiently collected from the kitchen and the cafeteria? Perhaps specially-marked containers can be placed in the cafeteria for collecting vegetable wastes only.

Suggestions for a Successful Composting Project

1. Start the project by collecting leaves, dry grass and other yard wastes. If these are not available, seek sources of shredded waste paper or find out how sawdust can be

acquired from a local lumberyard or farm. These high-carbon materials can be stockpiled next to your bin and added to the compost pile as necessary.

2. When you are ready to begin composting, collect cafeteria wastes after lunch and place the food waste (high nitrogen) in the bin. Cover this with two additional parts of the high carbon leaves, sawdust, or paper. Green grass clippings are a good alternative source of nitrogen.
3. If necessary, add water until the pile is as moist as a squeezed-out sponge. If water leaks out of the pile, it is too moist. Waste milk can be substituted for water.
4. Turn the pile very thoroughly (10-15 minutes) with a pitchfork before, twice each week while the pile is working. This will provide enough oxygen for odor-free composting.
5. Add more food wastes to the existing pile every day or as they are generated, combining them with equal parts of leaves or other carbon source. Turn the new ingredients into the center of the pile and add water as needed. Get student volunteers to take responsibility for the maintenance tasks each day.
6. When the pile of composting materials fills the bin, stop adding organic wastes. Turn this pile every three or four days *without adding new materials* to keep it well aerated. In two weeks or so, the compost should be cool, earthy, and dark in color. It is finished at this point, and can be put in bags or piles to cure or put directly on planting projects as a soil amendment.
7. During the time when you cannot add new wastes to the pile, it is a good idea to start a second compost pile. When one bin is full of composting materials, you can build a new pile in the other bin. This will allow for continuous processing of cafeteria wastes.
8. It will be helpful, if not necessary, to monitor the compost pile.

   Temperature. The compost pile should warm up to 90° - 140°F within a few days of building the pile. If it does not heat up, the pile is either too dry or lacking in nitrogen. Add water (or waste milk) until the pile is as moist as a wet sponge or add high-nitrogen materials (food scraps, fresh green grass clippings, manure, bone meal, blood meal). Turn the pile thoroughly.

   Moisture. If white, powdery fungus grows on the edges of the pile, the pile is too dry. A cover on the bin can help to keep moisture in.

   Odor. A pile that reeks of ammonia has too much nitrogen. High carbon materials should be blended in to alleviate this problem. A pile that smells rotten needs oxygen, which can be provided by a thorough turning with a pitchfork. In some cases, a pile that is saturated with water will also smell rotten because the excess water absorbs the oxygen in the pile and makes it unavailable to bacteria. If this occurs, dry materials should be added to the pile.
9. During the winter, composting can be difficult above ground. However, a dug-out compost pile will heat up quite well year-round if it is big enough or if it is covered and thereby insulated from the cold.
10. A compost pile does not need to be constantly attended. As long as the pile is not in the hottest stage of composting, it can be left alone over a weekend or a vacation week without problems. If the pile is at its peak, it should be turned vigorously before it is left alone. Remember, compost what you can when you can and don't worry. The compost will still be there when you return.

Follow Up

- Discuss what happens inside the pile that turns the food wastes into compost. (See background information on Composting)
- Record how much waste is put into the pile each day. This can be done carefully with a scale or roughly with volume estimates. Record how much compost is produced. How much did the pile diminish in size?
- Record and graph the temperature of the pile and the air daily.
- What are the factors affecting the composting rate at different times?

BEST COPY AVAILABLE

Plans for Constructing Compost Bins

Wire-Mesh Holding Unit

Materials

at least a 10-foot length of 32-inch-wide 1-inch galvanized chicken wire

or

at least a 10-foot length of 1/2-inch-wide hardware cloth (Note: The maximum bin diameter for a given length of chicken wire is the length of the chicken wire divided by 3.14.)

heavy wire for ties

three or four 4-foot tall wooden or metal posts (for chicken wire bin.)

Tools

heavy-duty wire or tin snips

pliers

hammer (for chicken wire bin)

metal file(for hardware cloth bin)

work gloves

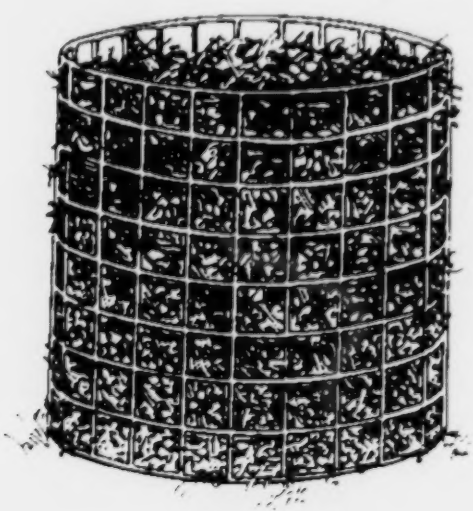
A wire-mesh holding unit is inexpensive and easy to build out of either galvanized chicken wire or hardware cloth. (Nongalvanized chicken wire can also be used, but will not last very long.) Posts provide more stability for a chicken wire bin, but make the bin difficult to move. A wire-mesh bin made without posts is easy to lift, and provides access to the compost that is already "done at the bottom of the pile while the compost at the top of the pile is still decomposing.

Building a Wire-Mesh Holding Unit Using Chicken Wire

1. Fold back 3 or 4 inches of wire at each end of the cut piece to provide a strong, clean edge that will not poke or snag, and that will be easy to latch.
2. Stand the wire in a circle and set it in place for the compost pile.
3. Cut the heavy wire into lengths for ties. Attach the ends of the chicken wire together with the wire ties, using pliers.
4. Space wood or metal posts around the inside of the chicken-wire circle. Holding the posts tightly against the wire, pound them firmly into the ground to provide support.

Building a Wire-Mesh Holding Unit Using Hardware Cloth

1. Trim the ends of the hardware cloth so that the wires are flush with a cross wire to get red o edges that would poke or scratch hands. Lightly file each wire along the cut edge to ensure safe handling when opening and closing the bin.
2. Bend the hardware cloth into a circle, and stand it in place for the compost pile.
3. Cut the heavy wire into lengths for ties, Attach the ends of the hardware cloth together with the wire ties, using pliers.



These plans were adapted from Composting to Reduce the Waste Stream, Northeast Regional Agricultural Engineering Service Publication No. 43, Cooperative Extension; Ithaca, NY, 14853.

Plans for Constructing Compost Bins

Wooden-Pallet Holding Unit

A holding unit can be built inexpensively using wooden pallets, or pressure-treated lumber may be used to make a nicer looking bin. The costs will vary, depending on whether new lumber or pallets are used. Used pallets are often available from manufacturers and landfills.

Building a Wooden-Pallet Holding Unit

1. Nail or wire four pallets together to make a four-sided bin at least 3 feet x 3 feet. The bin is then ready to use.
2. A fifth pallet can be used as a base to allow more air to get into the pile and to increase the stability of the bin.

Building a Holding Unit Using Lumber

1. Saw the 8-foot lengths of 2 x 4 pressure-treated lumber into four pieces, each 4 feet long, to be used as corner posts.
2. Choose a 3-foot square site for your compost bin. Use the sledge hammer to pound the four posts into the ground 3 feet apart, at the corners of the square.
3. Saw each of the five 12-foot boards into the 3-foot pieces. Allowing five boards to a side and, starting at the bottom, nail the boards to the posts to make a four-sided container. Leave 2 inches between the boards to allow air to get into the pile.
4. If you wish to decrease your composting time, build a second holding unit so that the wastes in one mature while you add wastes to the other.

Materials

four wooden pallets (five pallets if you want a bottom in the container), sized to make a four-sided container at least 3 feet x 3 feet x 3 feet

nails

baling wire

or

two eight-foot lengths of 2 x 4 pressure-treated lumber

five 12-foot lengths of 1 x 6 pressure-treated lumber

galvanized 8d nails (1 pound)

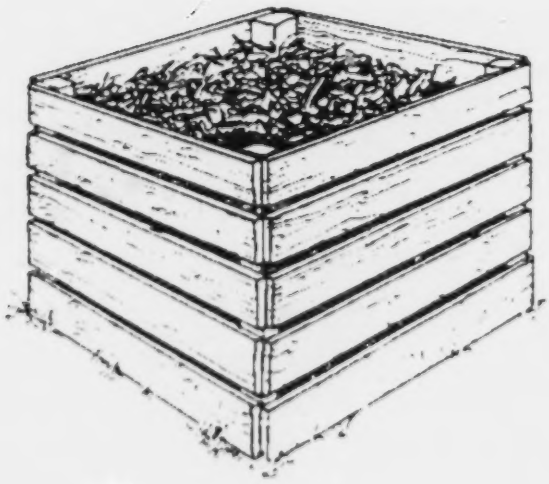
Tools

saw

sledge hammer

claw hammer

work gloves



These plans were adapted from Composting to Reduce the Waste Stream, Northeast Regional Agricultural Engineering Service Publication No. 43, Cooperative Extension; Ithaca, NY, 14853.

Pathways to Action
Composting

Plans for Constructing Compost Bins

Wood-and-Wire Three-Bin Turning Unit

Materials

- four 12-foot lengths of pressure-treated 2 x 4 lumber
- two 10-foot lengths of pressure-treated 2 x 4 lumber
- one 10-foot length of construction grade 2 x 4 lumber
- one 16-foot length of 2 x 6 lumber
- six 8-foot lengths of 1 x 6 lumber
- a 22-foot length of 36-inch wide 1/2-inch hardware cloth
- 16d galvanized nails (2 pounds)
- poultry wire staples (250)
- twelve carriage bolts, 4 inches long, with washers and nuts
- one quart wood preservative or stain

Optional materials-for lids

- one 4 x 8-foot sheet of 1/2-inch exterior plywood
- one 4 x 4-foot sheet of 1/2-inch exterior plywood
- six 3-inch zinc-plated hinges twenty-four 3/16-inch galvanized steel bolts, with washers and nuts

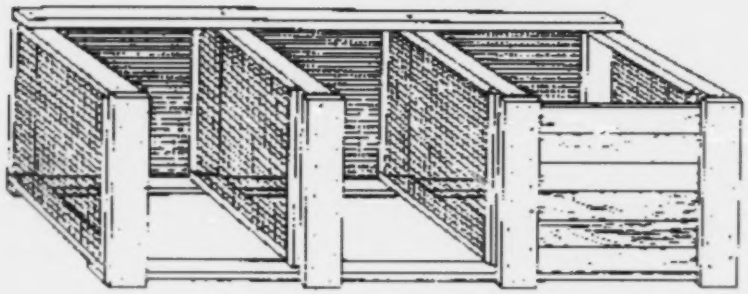
Tools

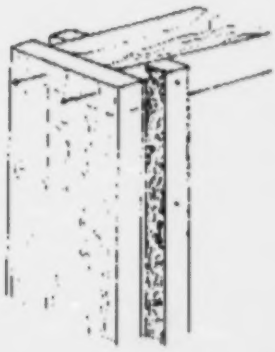
- tape measure
- hand saw or circular power saw
- hammer
- tin snips
- carpenter's square
- drill with 3/16-inch and 1/2-inch bits
- screwdriver
- adjustable wrench
- pencil
- safety glasses, ear protection, dust mask, and work gloves

A wood-and-wire three-bin turning unit can be used to compost large amounts of yard, garden, and kitchen wastes in a short time. Although relatively expensive to build, it is sturdy, attractive, and should last a long time. Construction requires basic carpentry skills and tools.

Building a Wood-and-Wire Three-Bin System

1. Cut two 31 1/2-inch and two 36-inch pieces from a 12-foot length of pressure-treated 2 x 4 lumber. Butt-joint and nail the four pieces into a 35-inch x 36-inch "square." Repeat, building three more frames with the remaining 12-foot lengths of 2 x4 lumber.
2. Cut four 37-inch lengths of hardware cloth. Fold back the edges of the wire 1 inch. Stretch the pieces of hardware cloth across each frame. Make sure the corners of each frame are square and then staple





the screen tightly into place every 4 inches around the edge. The wood-and-wire frames will be dividers in your composter.

3. Set two dividers on end, 9 feet apart and parallel to one another. Position the other two dividers so that they are parallel to and evenly spaced between the end dividers. Place the 36-inch edges on the ground. Measure the position of the centers of the two inside dividers along the 9-foot edge.
4. Cut a 9-foot piece from each 10-foot length of pressure-treated 2 x 4 lumber. Place the two treated boards across the tops of the dividers so that each is flush against the outer edges. Measure and mark on the 9-foot boards the center of each inside divider.
5. Line up the marks, and through each junction of board and divider, drill a 1/2-inch hole centered 1 inch from the edge. Secure boards with carriage bolts, but do not tighten them yet. Turn the unit so that the treated boards are on the bottom.
6. Cut one 9-foot piece from the 10-foot length of construction-grade 2 x 4 lumber. Attach the board to the back of the top repeating the process used to attach the base boards. Using the carpenter's square, or measuring between opposing corners, make sure the bin is square. Tighten all the bolts securely.
7. Fasten a 9-foot length of hardware cloth to the back side of the bin, with staples every 4 inches around the frame.
8. Cut four 36-inch long pieces from the 16-foot length of 2 x 6 lumber for front runners. (Save the remaining 4-foot length.) Rip-cut two of these boards to two 4 3/4-inch wide strips. (save the two remaining strips.)
9. Nail the 4 3/4-inch wide strips to the front of the outside dividers and baseboard so that they are flush on the top and the outside edges. Center the two remaining 6-inch wide boards on the front of the inside dividers flush with the top edge and nail securely.
10. Cut the remaining 4-foot length of 2 x 6 lumber into a 34-inch long piece, and then rip-cut this piece into four equal strips. Trim the two strips saved from step number eight to 34 inches. Nail each 34-inch strip to the insides of the dividers so that they are parallel to, and 1 inch away from, the boards attached to the front. This creates a 1-inch vertical slot on the inside of each divider.
11. Cut the six 8-foot lengths of 1 x 6 lumber into eighteen slats, each 31 1/4 inches long. Insert the horizontal slats, six per bin, between the dividers and into the vertical slots.
12. (Optional) Cut the 4 x 8-foot sheet of exterior plywood into two 3 x 3-foot pieces. Cut the 4 x 4-foot sheet of exterior plywood into one 3 x 3-foot piece on one of the three bins, and attach each to the back, top board with two hinges.
13. Stain all untreated wood.

These plans were adapted from Composting to Reduce the Waste Stream, Northeast Regional Agricultural Engineering Service Publication No. 43, Cooperative Extension; Ithaca, NY, 14853

Plans for Constructing Compost Bins

Garbage-Can Composter

Materials

garbage can with cover

coarse sawdust, straw, or wood chips

Tools

drill

pitch fork, shovel, or compost turner

work gloves

A garbage-can composter is inexpensive and easy to build. It can be used for food or garden wastes. The wastes do, however, need to be turned.

Building a Garbage-Can Composter

1. Drill three rows of holes 4 to 6 inches all around the sides of the garbage can. Then drill several holes in the base of the garbage can. The holes allow air movement and the drainage of excess moisture.
2. Place 2 to 3 inches of dry sawdust, straw, or wood chips in the bottom of the can to absorb excess moisture and let the compost drain.

These plans were adapted from Composting to Reduce the Waste Stream, Northeast Regional Agricultural Engineering Service Publication No. 43, Cooperative Extension; Ithaca, NY, 14853.

Incineration and Landfilling Projects

5 & 6 in the Waste Management Hierarchy

Incineration and Landfilling Pathways to Action

Landfill/Waste-to-Energy Comparison 146

Local Landfill Siting Proposal 148

Comparison of Waste Disposal Methods - Landfill and Waste-to-Energy

Level
■ **Intermediate**
◆ **Advanced**

Project Length
5 class periods

Related Activities
- *Bread and Kisses*
- *Getting to the Route of the Hazardous Waste Problem*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Home Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Overview

This is a research project in which students compare waste-to-energy incineration and landfilling as waste management (disposal) methods. Students work in small groups to gather and evaluate information about specific issues, then come together to discuss the benefits and trade-offs of each method. Students are encouraged to contact local waste management professionals for information. Classes are encouraged to reach a consensus about which method is preferable and to express this opinion to local and state elected officials. Field trips to incinerators or landfills are recommended.

Background

Waste disposal is at the bottom of the Waste Management Hierarchy and is the least preferable method of dealing with MSW. Ultimately though, there are no other options for some wastes. In Maine, when disposal is necessary incineration is generally preferred over landfilling.

The background information sections on Landfilling and Waste-to-Energy may be helpful to both teachers and students, especially to verify data gathered from other sources.

Suggested Contacts:

1. For many issues, direct contact with incinerators or landfills will be best.

   Some of Maine's Major Landfills:
   Crossroads Landfill, Norridgewock, 1-800-562-7779.
   Hatch Hill Landfill, Augusta, (207) 626-2365.
   Sawyer Environmental Services, Bangor, (207) 947-4997.
   Tri-Community Recycling and Sanitary Landfill, Caribou, (207) 473-7840.
   Maine's Major Incinerators:
   Maine Energy Recovery Company, Biddeford, (207) 282-4127.
   Mid Maine Waste Action Corporation, Auburn, (207) 782-7716.
   Penobscot Energy Recovery Company, Orrington, 1-800-698-0859.
   Regional Waste Systems, Inc., Portland, (207) 773-6465.

2. The Maine Waste Management Agency can be helpful on a variety of issues. 1-800-662-4545. They provide an excellent listing of facilities, haulers and other resources which is updated regularly: Waste Management Services Directory (MWMA.)
3. For regulation issues and environmental hazards, try the Maine Department of Environmental Protection, Division of Solid Waste Facilities Regulations in the Bureau of Hazardous Materials and Solid Waste Control. Phone 1-800-452-1942.

Planning Considerations

1. This project requires students to research a particular issue using sources outside the classroom. The school library may be a good resource, but encourage students to use other resources: The local library, the people at the town waste transfer station, the municipal landfill, or a nearby recycling center as sources of information.

2. Allow homework time for the research portion of this project. This will make it easier for students to call or visit town waste management resources on their own.
3. Some people that students interview may be biased when they provide information. For example, if the town landfill is a health hazard, the landfill operator may avoid questions about its safety. How can students work around this problem to verify the information they collect?
4. Preparatory work with the Solid Waste Management Options flow chart will have identified how waste is handled in your town. If it is taken to a transfer station, is it ultimately landfilled or incinerated?
5. Consider taking a field trip to an incinerator and a landfill.

Suggestions for a Successful Project

1. Divide the class into small groups. Each group will be responsible for examining one or two particular issues in detail and reporting their findings back to the group. Each group is to compare waste-to-energy incineration and landfilling. Above are ten issues that can be considered, or make your own list!
2. This is a comparison project. Even if students are unable to come up with detailed information about an issue, they may still be able to make a meaningful comparison between the two methods of waste management. (For example, they may not determine the specific cost to build a landfill, but they may discover it is less expensive than building an incinerator. They may even be able to ap*proximate how much less expensive* it is.) Although the sizes of the state's incinerators and landfills vary, for the purposes of this comparison, have students compare any of Maine's landfills to any of the state's incinerators.
3. After information is gathered, each group should come to a conclusion about which technology is preferable with respect to their issue. (For example, "As regards operating costs, landfilling is preferable to incineration.")
4. Hold a class discussion in which each group presents their findings to the class, using relevant data to back up their conclusions. It may be helpful to make a chart indicating the recommendations of each group.
5. When all groups have reported their findings, come to a consensus as a class about which method of waste incineration is preferable. Consensus may not be attainable, which is okay.
6. Evaluate the town's method of waste disposal according to the class consensus.

Issue	*Landfilling*	*Waste-to-Energy*
1. Construction costs		
2. Operating costs		
3. Environmental costs		
a. Air pollution		
b. Groundwater contamination		
4. Regulation costs/needs		
5. Effect on waste volume		
6. Tipping fees		
7. Incentives to consumers		
8. Use of trash resources		
9. Necessare scale of operation/ need for technology		
10. Life span		

Follow Up

- Have each student write a letter to the town council or Board of Selectmen expressing his or her opinion about how waste is handled in the town. Encourage students to use the information that was gathered by the class to back up their arguments. Students may have personal opinions that differ from the class conclusion. But remember, a letter of support to the town is as important as a letter of disapproval.
- Write letters of thanks to all individuals who provided information. Include a description of the conclusions reached by the class.

Pathways to Action
Incineration and
Landfilling

Landfill Siting Investigation

Level
◆ **Advanced**

Project Length
2 class periods

Related Activities

- *Bread and Kisses*
- *Getting to the Route of the Hazardous Waste Problem*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Home Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Overview

This is a research and planning project in which students try to identify an appropriate landfill site within the town boundaries. Students use the same major criteria that state officials use in making landfill siting decisions. They also wrestle with the emotional issues (e.g. NIMBY) that emerge in most real town siting proposals. The class concludes by proposing, defending, and voting on a specific site for locating the landfill.

Background

The background information section on Landfilling may be helpful to both teachers and students.

Landfill Siting Criteria

When any state agency or municipality looks for a new landfill site, they must follow certain guidelines as to where the landfill will be located. There are two different types of guidelines: *Exclusion criteria*, which specify where landfills *cannot* be located, and *Preference criteria*, which specify where it would be *best* for landfills to be located. The table below is a simplification of the actual landfill siting criteria used in the state of Maine, established by Maine Revised Statutes Annotated Title 38 (called Chapter 450). Given a specific issue, the table answers the question, "According to this criterion, where can the landfill be located?"

Planning Considerations

1. This action project can be particularly useful for students in a town where landfill siting issues have been discussed recently. It is valuable, however, for students in any town, as it makes the difficulty of deciding this issue very clear.
2. Materials:
   This project will require one detailed map of the town showing a clear scale. The teacher can probably acquire a suitable map in advance of the project from the town office. A simple map showing major lakes, streams, roads, and possibly buildings will be best. A separate copy of the map will be necessary for each group of students (and it may be helpful for each group to have more than one copy). Ideally, each group would have a transparent overlay of the town map to work with.
   Additional maps will be essential resources, including:
   - Surface water and "land suitability" maps from the town office;
   - Soil-type maps from the Soil Conservation Service, (listed by region in the phone book under United States Government, Department of Agriculture);
   - Topographical maps from the Maine Geological Service (207) 289-2801;
3. If all of the resource materials recommended here are not available, modify or eliminate parts of the activity.
4. This project requires some significant time and research on the students' part. Parts of this investigation should be assigned for homework.

Suggestions for a Successful Investigation

1. Divide the class into approximately five small groups. Each group will be responsible for investigating one set of concerns, as listed in the siting criteria.
2. Each group will need to determine which areas in the town are not suitable for a landfill (excluded or "preferably excluded") based on their assigned concerns. For example, the group investigating surface water concerns will need to use maps to find all the year-round surface

Exclusion	Issue	Notes	Preference
SURFACE WATER CONCERNS			
not within 300 ft.	Proximity to surface water source (rivers, brooks, streams, great ponds)	1,2	not within 1000 ft.
not within 300 ft.	Proximity to coastal or freshwater wetland (tidal or freshwater marsh, bog, swamp)	1,2	not within 1000 ft.
not on 100-year floodplain floodplain	Potential for coastal or freshwater flooding	5	not on 500-year
GROUNDWATER CONCERNS			
not located in soil type A or B, (gravel or sand)	Proximity to sand or gravel deposits and aquifers (soil types A and B)	3,4	not within 300 ft.
GEOLOGIC CONCERNS			
not in an unstable area; no landslides or mudslides	Stability of land (Optional - may be difficult to determine!)	6	not within 200 ft. of a fault
no exclusion criteria	Grade of landfill site	2	not more than 8%slope (80 ft. rise in 1000 ft. distance)
WILDLIFE, NATURAL AREAS CONCERNS			
not in wildlife preserves, etc.	Proximity to wildlife management areas, preserves, refuges, and sanctuaries	1,2	not within 1000 ft. of preserves, etc.
not in these areas	Proximity to areas of significant wildlife habitat, critical areas, 'fragile' mountain areas, 'unusual' areas	1,2	not within 300 ft. of these areas
not within 1000 ft.	Proximity to state and federal park boundaries, Appalachian trail	1,2	not within 2,640 ft.
not within 1320 ft.	Proximity to major lakes	1,2	not within 2,640 ft.
OTHER CONCERNS			
not in these areas	Proximity to federally-owned or non-profit-owned land preserves	1	not within 1000 ft.
not in these areas	Proximity to National or State Historic Sites and significant archaeological sites	1	not within 300 ft.
not within 1 mile	Proximity to FAA licensed airport	1,2	not within 2 miles
no exclusion criteria	Proximity to Primary Viewing Locations (the ocean, islands, parks, AT, ponds, rivers, scenic or interstate highways)	1,2	not visible

Notes:

1. Information available on town maps.
2. Information available on Maine Geological Service Topographical maps.
3. Information available on Soil Conservation Service Soil type maps.
4.Information available on Town Land Suitability maps.
5.Information available from town historical records, oral histories.
6.Information available from state geological maps.

water in the town. The group investigating geologic concerns will need to use maps and other resources (e.g., contact with the Maine Geological Service) to find all places in the town with a grade of greater than 8%.

3. The final goal for each group will be to produce a marked-up copy of the basic town map that indicates areas from which a landfill would have to be excluded (based on their specific concerns) and where it would be "preferably excluded." It is recommended that each group be assigned a different color. **Excluded areas should be colored with a solid color; preferable exclusion areas should be darkened with cross-hatching.** [For example, the group focusing on wildlife concerns would color in all areas on their town map that are wildlife refuges, preserves, sanctuaries, or management areas in solid yellow; they would cross-hatch all areas within 1000 feet of these regions with yellow. The group investigating surface water concerns would color in all surface waters with solid blue on *their* town map; they would cross-hatch all areas within 1000 feet of surface waters with blue.]
4. In some cases, it will not be clear exactly where the land meets certain criteria. For example, it can be very difficult to determine, even with the best information, where a geologic fault lies. It may be unclear whether a certain landfill site would be visible from the highway. These difficulties are also encountered by state officials in the process of siting a landfill! Students should be encouraged to make the best decisions they can in the face of uncertainty, and to note the basis for their decision for later discussions. In general, it will be better for them to exclude more land from consideration than to include too much.
5. When all groups have marked up their respective maps, they should display them individually, and a composite town map should be constructed that combines all "excluded" and "preferably excluded" areas for each of the siting concerns. The result will be a colorful map; all white (unmarked) areas on the composite map represent preferred landfill sites. (If transparent map overlays are used for the project, they can easily be combined to form the composite map.)
6. It is interesting to note that many areas are NOT EXCLUDED from consideration for landfill sites. Examples:

- Town zoning laws do not specifically affect landfill siting. The Chapter 450 criteria do state, however, that preference be given to areas that minimize land use conflicts. Local zoning does figure into this criterion. The Maine law states that "local zoning laws are advisory to the state."
  - Lands not within 300 feet of streams or ponds, may be considered for landfill sites. Lands within the watershed of any class AA streams are excluded by Chapter 450 criteria.
  - Privately owned and residential areas may be considered as potential landfill sites. Of course, heavily settled areas may be rejected to reduce land use conflicts. (The State can purchase privately-owned lands with the justification of eminent domain.)
  - Lands owned by power companies may be considered, including land for power lines. If there were any power lines that would have to be moved, the site would most likely be rejected.

7. Still, the state has some other guidelines for siting landfills, including:
   - The site should be near existing transportation systems (roads, rail lines, etc.)

- The costs of the landfill construction should be reasonable.
- Conflict with adjacent land should be minimized.

Given these guidelines, it may be possible to exclude other areas from consideration in the town, such as well-established residential areas, school grounds, etc. These areas can be colored in on the composite map.

8. With the composite map complete and on display, discuss with the whole class where the best locations for a landfill are inside the town limits. Assume that a moderate-sized landfill needs to be constructed in the town covering approximately 20 acres, with a total land requirement of 100 acres for a sizable buffer zone. (Note that the buffer zone would not need to meet exclusion restrictions.) This will require approximate dimensions of 2000 feet by 2000 feet. Draw a square of this size (to scale) on a corner of the town map so that students can visualize how much land is necessary.
9. During the discussion encourage students to express their concerns about the landfill site based on their research as well as their personal background. For example, if a site is being considered near a neighborhood, encourage any students who may actually live in that neighborhood to express their sentiments for or against the landfill.
10. After sufficient discussion, take a class vote on which of the potential sites is the best one for a landfill.

Follow Up Questions

- How easy was it to find a suitable landfill site based on the state guidelines?
- Were any sites found that all students agreed upon?
- Contact the town office. Did the town used to have a landfill, or does it have one now? Where is it located? Is it in a place that meets all siting criteria?
- Write letters of thanks to all those who helped provide information for the research.
- Write a report which descries the project and the results. Submit copies to the town planning committee and to the Landfill Siting Office of the Maine Waste Management Agency.

Pathways to Action

Household Hazardous Waste Reduction Projects

Success Story

Thanks to Mrs. Postlewaite and her students, families in Dover-Foxcroft are throwing less toxic material down the drain and into the trash!

In the summer of 1992, Elizabeth Postlewaite took a course in Pollution Prevention with Dr. Marquita Hill at the University of Maine. The course focused on raising awareness of pollution issues and of the many chemicals and chemical products in our lives. As her P^2 project, Mrs. Postlewaite developed lesson plans to have her middle school students investigate alternative home cleaners.

During the unit, SeDoMoCha Middle School students learned about the dangers of household cleaners and how to recognize harmful ingredients. They researched environmentally safe alternatives and tested those alternatives, both at school and at home. As a final project some of the students produced a pamphlet, "The Safe Cleaning Kit," which provided information about reading labels and listed recipes for non-toxic cleaners. With their recipes in hand, many families actually signed a contract to create an "Environmentally and Personally Safe Home." Now, there is a much stronger commitment in Dover-Foxcroft to reduce the use of toxics around the home and at SeDoMoCha Middle School.

Much of the information Mrs. Postlewaite got from her Pollution Prevention course is included in *Pathways to a Sustainable Future* . Many of the recipes from the pamphlet by Courtney Dean and Desiree Preble are included in the activity "Test the Alternatives."

Household Hazardous Waste Reduction Pathways to Action

Promoting Alternatives to Hazardous Products 154

Waste Paint Exchange Project 155

Battery Use Reduction and Rechargeable Promotion 157

Pathways to Action
Household Hazardous
Waste Reduction

Promoting Alternatives to Hazardous Products

Level
■ **Intermediate**
◆ **Advanced**

Project Length
5-10 class periods

Related Activities

- *Drop in the Bucket*
- *If Toys Could Talk*
- *Bread and Kisses*
- *Getting to the Route of the Hazardous Waste Problem*
- *Everyday Choices for a Sustainable Future*
- *Test the Alternatives*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Overview

Students use their experience from the awareness activity Test the Alternatives where they learned about alternative household cleaners to generate strategies for promoting alternative products. Small groups design different projects like producing a flyer for students and parents or designing an informational poster campaign. They focus on providing information about the dangers of toxic household products and getting others to use alternatives to toxics.

Background

"Test the Alternatives," "Everyday Choices" and "Getting to the Route of the Hazardous Waste Problem" are activities that will help introduce students to the issues of household hazardous wastes. Much of the student research for this action project may come from those activities along with the background information section on Household Hazardous Wastes.

References

Background information section on Household Hazardous Wastes

CHMR Hazardous Materials Fact Sheet: Household Hazardous Substances—and Alternatives (Center for Hazardous Materials Research, University of Pittsburgh)

Model Graphics for Developing Recycling Promotional Material (Maine Waste Management Agency - clip art for brochures)

Additional resources are available from the Chemicals in the Environment Information Office, University of Maine, Orono; Natural Resources Council of Maine, Augusta.

Planning Considerations

1. Enlist the support of specialist staff in the school like the computer instructor and art instructor.
2. Consult with the principal, food service, and custodial staff about the possibility of using alternative cleaning products in the school. They may help students test the alternative products, or review their projects.
3. The audits will help pinpoint problem areas in the school and in homes. Use the audits to set priorities for student projects.

Suggestions for a Successful Promotion Project

1. Prepare students by doing the activities "Everyday Choices" (especially the sections on glue, batteries, and hazardous materials) and "Test the Alternatives." This will give them most of the information they'll need to start their promotion. Review the dangers associated with household hazardous products, and label "signal words."
2. Brainstorm possible small group activities for this project. Possibilities include an informational poster campaign for the school, a brochure for parents and students, a public display for the mall or a grocery store, or a video or print advertisement for the alternative products.
3. In the small groups, have students define their project, divide research responsibilities, research the topics, and make an outline for the project.
4. Produce the brochure, posters, or other product. Take advantage of all the resources available such as a computer graphics program, art instructor and materials, etc.
5. Duplicate and distribute the final products.

Follow-Up

- Send an article to the local newspaper with samples of the projects. Ask the editor to print projects in an article or as a supplement.
- Check with users of the products after a month to see how effective they are and if they are still using them.

Waste Paint Exchange Project

Overview

Students organize a waste paint exchange for their families and the community. They research the hazards of paint and strategies to deal with waste paint. They contact local service organizations, locate groups that could use leftover paints, and promote participation in the exchange. After the exchange students arrange for the recycling or proper disposal of cans and other materials.

Level

■ **Intermediate**

◆ **Advanced**

Project Length

5 class periods and a Saturday exchange day

Related Activities

- *Drop in the Bucket*
- *Bread and Kisses*
- *Getting to the Route of the Hazardous Waste Problem*
- *Everyday Choices for a Sustainable Future*
- *Test the Alternatives*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Background

The average American family has about four gallons of old paint stored in the basement or garage. It is estimated that unused paint accounts for 50-80% of the hazardous waste dumped by households. Old paint that is dumped or disposed of improperly can pose a serious threat to human health and the natural environment. Solvent-based (alkyd or oil-based) paints have more hazardous components than water-based (latex) paints. Yet, latex paints contain toxic substances and should be handled properly.

There are few alternatives for properly disposing old paint. Household hazardous waste collection programs are rare because they are very costly to communities. Paint should not be placed in landfills or incinerators because of the potential for contamination. However, empty paint cans and lids can be recycled along with other steel or tin cans. They do not have to be scrubbed clean, but should be empty. A thin skin of dried latex paint may be left on the bottom and sides of the can. Cans with small amounts of latex paint can be left open outside (away from people or pets and) and allowed to dry. The dried paint should then be discarded with the trash and the can recycled.

Paint that cannot be used or given away should be clearly marked and stored with a tight lid until a collection program is available.

Source reduction is the best way to avoid the disposal dilemma: Only buy as much paint as you need for the job. Using paint completely is the next best choice: Paint another coat, or offer to paint a neighbor's dog house. At a waste paint exchange, households can donate usable quantities of paint to other households or groups working on community projects. They can also combine their small amounts of leftover paints to make enough for a gray or brown undercoating job. This community effort will eliminate a significant amount of hazardous material from the waste stream, and it will raise awareness about problems associated with paint.

References

Background section on household hazardous wastes

Maine Waste Management Agency Fact Sheet: Waste Paint

Planning Considerations

1. Get approval from the school administration for conducting the Exchange. Learn about any school policies, liabilities, or restrictions that will affect your project.
2. Conduct a household hazardous waste audit to determine the amount of waste paint students are likely to encounter. Review the results of the HHW audits and determine if waste paint is a problem.
3. Contact the DEP to determine restrictions and regulations you will need to follow.
4. Plan the exchange to coincide with a time in the spring or fall when people are doing house and yard clean-up projects.
5. The exchange should involve only households. Paint contractors are required to dispose of their waste as mall quantity

Waste Paint Exchange Project

generators and are governed by DEP regulation. They should not participate in your household exchange.

Suggestions for a Successful Exchange

1. Brainstorm possible uses for waste paint and ways of getting waste paint to people who can use it. What groups, projects, or people in your area could use waste paint?
2. Discuss the steps involved in a waste paint exchange. Identify the responsibilities ("things to do") and assign individuals or pairs of students to the tasks. Tasks might include contacting recipients for the paint to get their support and identify their needs for paint, publicity, arranging the location, getting the necessary permissions, planning safety procedures.
3. Write out a clear description of the project to be used in publicity and in discussions with community groups who may be receiving paint. Ask them to help promote the exchange.
4. Work out the final logistics for the exchange like scheduling workers, safety equipment, set-up, clean-up.
5. On the day of the exchange be sure there is news coverage of the event. If not, take home video of the exchange. Keep track of the amount of paint that is exchanged and who participates.

Follow-Up

- Compile statistics of how much paint was exchanged for reuse. Make posters and write out a report describing the success of the project.
- Prepare news articles and a video report of the event.
- Write thank-you letters to groups that participated.

Battery Use Reduction and Rechargeable Battery Promotion

Overview

Students promote alternatives to using disposable household batteries. Their research shows how dependent they are on batteries and how damaging batteries can be when they are discarded in landfills or incinerators. Students generate ideas and carry out a plan for themselves, their families, the school, and other students to reduce disposable battery use and to promote the use of rechargeable batteries.

Level

■ **Intermediate**

◆ **Advanced**

Project Length

3-5 periods

Related Activities

- *Drop in the Bucket*
- *How Much Trash!*
- *If Toys Could Talk*
- *Bread and Kisses*
- *Getting to the Route of the Hazardous Waste Problem*
- *Everyday Choices for a Sustainable Future*
- *Test the Alternatives*
- *School Waste Audit*
- *School Hazardous Waste Audit*
- *Home Household Hazardous Waste Audit*
- *Local Waste Management Options*

Background

Americans throw away 2.7 billion batteries each year. Many batteries contain toxic heavy metals like mercury, cadmium, lead, and zinc. Household batteries are inefficient. At 2% efficiency, it takes fifty times more energy to make a battery than it produces for the user.

Disposable household batteries are now being made without added mercury or cadmium and are labeled "Safer for the Environment." However, it is not yet profitable to recycle these batteries. Only a few types of batteries are recyclable. Button batteries contain up to 40% by weight mercury or silver, and it is profitable for manufacturers to collect and recycle them. Recycling programs are also being developed for silver-oxide, lithium, and nickel-cadmium batteries. The Maine legislature has passed laws to require recycling of button and rechargeable batteries, but most household batteries continue to contaminate landfills and incinerators with heavy metals.

Rechargeable household batteries are usually the nickel-cadmium (ni-cad) type which can be recycled. But even better, using rechargeables reduces the number of disposables in the waste stream. Solar rechargeables rely only on the sun for power and no other energy resources are used. People often complain that rechargeable batteries run down much faster than disposables, and they take many hours to recharge. Longer-lasting rechargeable batteries are being developed, and the efficiency of these batteries is improving over time. Rechargeables are recommended for "heavy-drain" products like radios and toys rather than infrequently used items like flashlights or smoke detectors. The batteries and chargers are usually available at electronics stores and through mail order catalogs that promote earth-friendly products.

Contact the Environmental Action Coalition (EAC), 625 Broadway, New York, NY 10012, (212) 677-1601. The EAC provides information on a variety of issues including waste batteries, battery legislation, and pilot collection programs. They can respond to requests for specific information on environmental effects of batteries, source reduction, current legislation and market conditions.

References

Background information on Household Hazardous Waste

MWMA Fact Sheet: Household Batteries

Battery Use Reduction and Rechargeable Battery Promotion

Planning Considerations

1. Batteries shouldn't have been separated out in your school or home waste audits since without a collection program, it is better to place them in the trash is small numbers and not to concentrate waste batteries. The inventories should generate figures to show battery use in school and at home (per person per month, per teacher per year, etc.)
2. Communicate with parents about the battery reduction effort. Enlist their support helping with at-home activities.
3. Notify school officials and other teachers that your students will be promoting alternatives to disposable batteries.
4. Provide background information for students or material they can use to research battery use, the problems batteries cause, and facts about rechargeable batteries.

Suggestions for a Successful Effort

1. Inventory battery-using toys and appliances at school and at home. Make lists of all products that use batteries, noting the type of battery used, the purpose of the product, and its location.
2. Discuss the reasons why we have those products (consider safety, education, convenience, recreation.)
3. Brainstorm alternatives to those products or alternative sources of power for them.
4. Discuss and list the reasons batteries pose a problem in the waste stream. List alternatives to using disposable batteries.
5. Gather facts about rechargeable batteries: What is their effectiveness, sources, initial cost and the cost to use them compared to disposables?
6. Contact the Maine Waste Management Agency to get the most up-to-date information about battery laws and recycling efforts in Maine. Battery manufacturers can also provide information. The authors of *Going Green, a Kids Handbook to Saving the Planet* suggest sending used batteries back to the manufacturers and encouraging them to recycle.
7. Brainstorm ideas for actions students can take to reduce dependence on disposable batteries. Include actions they and their families can take, actions the school can take, and ways to convince others to change their habits. Discuss and refine the brainstorm list.
8. Consider a publicity campaign to promote rechargeables in conjunction with a retailer of batteries and chargers. Try to include solar chargers as an option.
9. Make plans for getting those ideas to work. In small groups, prepare materials, make posters, plan presentations to others, write a report, etc.

Follow-Up

- Continue to collect batteries. Compare battery use after the project to the original figures.
- Evaluate the effectiveness of the projects. Estimate the number of disposable batteries saved. Project that estimate for an entire year.
- Write letters of thanks to officials involved and others who helped in the project.
- Write an article for the local newspaper describing the project and the results. Request support from the public in continuing the effort.

Pathways to Action

Tools for Action

Resources and strategies that help in all action projects

Success Story

Students at the Soule School in Freeport were worried about ozone depletion in the atmosphere. In discussions to help them deal with this "ecoanxiety" their teacher, Margaret Pennock, worked to free them to express their feelings and then helped them design action steps to reduce their anxiety, address the ozone problem in a concrete way, and make Freeport and the world a healthier place.

The plan of action called for a ban on the use of polystyrene packaging in Freeport. The students wrote an ordinance proposal and petitioned the local community to support it. Then they defended their proposal at a hearing of the town council. The ordinance passed the Freeport Town Council unanimously in July 1989. The success of this student-initiated project made national news, and brought notoriety and even invitations to Russia (then Soviet Union) for some group members.

The group was cohesive and developed a strong identity. Their commitment to the environment continued to grow. To tap their need for organization and satisfy the urge to help others form similar groups, Ms Pennock and several parents created a support group called Concerns About Kids' Environments (CAKE) to help train people in other communities to help transform young people's environmental concerns into action. CAKE volunteers provide support to people who want to help children take positive action in support of their environment. Contact CAKE at 29 Pine St., Freeport, ME 04032, 865-6263.

Tools for Action

Letter Writing for Results 160

Publicity 162

Public Service Announcements 164

Pushing for a Change 168

Letter Writing for Results

Overview

These suggestions will help students put the skills they need to write effective letters into practice and get results. They focus on effective ways to ask for or report information, to state their opinion or to persuade others to their point-of-view, and to ask for help or support. Strong letter writing skills can help students in every action project in this guide, but the only way to really gain the skills is to do *the writing.*

Background

Writing letters can be an important strategy for making an action project really work. Businesses and manufacturers don't usually get letters from customers, and politicians use letters to measure public opinion. According to John Elkington in *Going Green: A kids handbook to saving the planet* (1990) if a company or politician gets just 20 letters on the same subject within a few weeks, they consider the subject a high priority. Expressing your concerns or needs clearly and convincingly helps get results. Getting classmates friends to join the effort makes the point even stronger.

A source of good ideas is *The Kid's Guide to Social Action: How to solve the social problems you choose - and turn creative thinking into positive action* by Barbara Lewis; Free Spirit Publishing, Minneapolis; 1991.

General Suggestions for Successful Letters

1. **K-I-S-S**: Keep it short and simple! As difficult as many students find reading and understanding, adults often don't read carefully or well. Busy people may not take the time to read a long letter. You should keep your letter less than a page.
2. The letter should focus on a single issue or request.
3. It is usually best to state who you are, what your project is, and what you want from the person (or how you'd like them to respond) in three or four sentences in the first paragraph.
4. Give more information about the project (or issue), and reasons why the person should help you (or believe you) in the next paragraph. This may not be needed in a simple letter requesting information.
5. Finish by restating the request or your major point in the last paragraph.
6. Use proper business letter form, including a return address and inside address. Using the school letterhead, or a special project letterhead (with return address) designed by students can make the letter stand out.

7. Be polite, even if you disagree with the person to whom you are writing.
8. Proofread the letter and make corrections before sending it out.
9. Expect a response to most letters (except a letter to the editor.) The response may agree or disagree with your opinion, but should not discount what you had to say. Letters from big manufacturers often say they have already thought about that issue and everything is OK. If there is not good proof, be prepared to write a follow-up letter to challenge their response!

Letter to the Editor

1. Look for guidelines printed in the magazine or paper you are writing to. They are usually found at the end of the letters section.
2. Use the greeting *Dear Editor:* and close it with *Sincerely, (your name).*
3. Send a type-written letter or letter from the computer if possible. Double-spacing makes it easier to read. If the letter is hand written, it is fine. Be sure to write neatly.
4. If you don't want the paper to use your name, ask the editor not to print it. But you must sign your name if you want the letter to be printed.
5. Never make an accusation about someone or a product without proof. Avoid libel (making someone look bad unfairly), you can get sued for making false statements!

Letter requesting information

1. Keep the letter very short.
2. Simply state your request and how you'd like the person to respond.
3. Plan ahead and allow at least a few weeks for a response.
4. Be sure the return address is clear so the response can get to you as quickly as possible.

Publicity

Overview

Any project worth doing deserves to be promoted. You can let the world know about your project and about how other people can carry on your good work. Get your word out with newspapers, newsletters, flyers, exhibits, public meetings, or contests. Each action project lends itself to some form of publicity, and your project will have a wider reach and greater impact when you make it public. Presenting information to the public is also an excellent demonstration of learning or addition to a student's portfolio.

Press Release

A press release is a written statement describing an event and is sent to newspapers, television, and radio news departments. Press releases may announce an upcoming event or a report an event after it has taken place. Notices of upcoming events may attract reporters to cover the story. A newspaper might print the release directly, or have a reporter use the information as the basis of an article of his or her own.

Send press releases to all your media contacts two or three weeks in advance of an event. The media are more likely to schedule coverage or to list the event in their calendar section. The release should be typed (or written on a computer) and double spaced if possible. If not, be sure it is easily readable. Try to keep it to one short page.

At the top of the press release indicate:

- "For Immediate Release"
- Date
- Contact person/Address/Phone number

The message of the press release should be clear and to-the-point. Be sure to include the five "W's": Who, What, When, Where, and Why details. Editors and reporters pay more attention to material that is catchy, humorous, or unusual. They are often more interested in press releases written by kids than those by adults.

Newspaper Article

Articles printed in the paper usually contain more information than press releases. You can use an article to report on an event yourself, or to convey information gathered during your project. Write the article and submit it to your local or regional paper. If you include a good photograph they may publish it with your article.

Like the press release, a newspaper story should include the five "W's" and have a relate to the wider community. Kids' stories that demonstrate their convictions about the environment and their success in an adult world are very compelling.

Many good articles begin by describing an individual's role in a project or effort and follow through with what that person had to endure, what she learned, or how he changed and influenced others. You can work information into the story and educate people in the process of telling about your project. Again, well-written stories by children are very appealing to the public, and to editors!

Flyer or Newsletter

Compile the information generated during your project into a flyer or a newsletter that you can distribute to parents, other students, or the public in general. Decide on a main theme for a newsletter and include short articles that relate to the theme. Devise a single, clear message for a flyer and include

supporting information. As in a Public Service Announcement, you should have the reader do something or respond with some specific action.

You can design an attractive layout for a flyer or newsletter on a computer. If you or the students don't have any experience with layout, consider asking a parent, or use other resources in the school district. The printed piece should be uncluttered with a clear message. Create a logo or banner that includes names, address, and phone number. The Maine Waste Management Agency provides a booklet of clip art that can make your piece look more professional. Ask the MWMA for: *Model Graphics for Developing Recycling Promotional Material*. Be sure to date the publication.

Public Meetings - School Board, Civic Groups, Church Groups

Present your project, your conclusions, or your problem to the people who can help support you or help spread the word. Let students do as much of the presenting as possible. However, they need to be well prepared to project a clear message and a make direct request. Visual aids, like video, slides, or charts help make information interesting, and can take a little pressure of the students. You should keep the presentation short, usually less than 15 minutes.

Describing your project or providing information is the easiest type of presentation. You should try to relate to the interest of the group, and give them information they can use or act upon.

It is more difficult to convince the school board or a civic group to support a proposal, especially if you are asking for money. In your presentation, answer the questions:

- Exactly what is the project trying to do?
- What support are you asking for?
- Why does the project deserve their support?
- What will they get as a result of the project?
- When will they see the results?

When you involve a wider community, more people will benefit from your work and they will become invested in the process.

Library Exhibit

An exhibit is a more passive method of spreading information, yet you can reach a large and receptive audience. School libraries and public libraries often have display tables available on a rotating basis. Arrange with the library director to schedule a time slot for your display. Plan ahead because library displays are often scheduled far in advance to coincide with special events or national observances.

Prepare a display of posters, brochures, photos, and/or models to get your information across. Often librarians like to have the displays relate to books or resources patrons can find in the library. Work with the librarian to have your display meet their guidelines and the needs of their patrons. Again, provide an opportunity for a viewer to respond or to take action. Provide enough brochures or handouts for the number of viewers anticipated.

Poster Contest

If your project has a slogan or a message you can express in a few key words, consider promoting a poster contest for students in your school or other schools in your district. A poster contest can generate a lot of interest, especially in younger students.

Send a flyer announcing the contest and explaining your basic message to the appropriate schools. Include the deadline, list of prizes, and where to send the completed posters. You might open the contest to the public (set age limits) and post the announcement in public places and put a notice in the paper.

Offer a prize, or prizes, for the best poster or poster/slogan combination. Students in your class can judge the posters. Display the winning posters in the school, post office, downtown shop window, or bank.

Pathways to Action
Tools for Action

Public Service Announcement

Overview

Any of the Action Projects in Pathways to a Sustainable Future *can lead to developing a public service announcement. This resource page describes how students can get their message, no matter what the topic or concern, out to the public. The public service announcement can be presented with live student actors for the school community, or recorded on audio and video tape. The PSA can be shown in schools and the community, submitted to radio, television or cable stations to (possibly) be aired. WCSH-TV 6 Alive! has agreed to accept PSAs from* Pathways *action projects and may use them or re-produce them to show statewide on Channel 6 (Portland) and Channel 2 (Bangor).*

Background

A public service announcement (PSA) is a short statement which expresses concern for a problem and asks either directly or indirectly for the listener to respond in some way. PSAs related to *Pathways* action projects should convey the concern addressed by the class, present information about the subject, and/or convince the audience to join the effort with some specific action. Most broadcast stations allow free air time to non-profit groups (including schools.) They are very selective, however, so any PSA for broadcast should be very carefully planned and prepared. The PSA for broadcast should be designed for a wide audience; more than for your local community.

The usual time slots allowed for PSAs are for *exactly* 10, 20 or 30 seconds. Each station may have other special rules or guidelines for a PSA. You should contact the station before planning the PSA so it can be designed properly.

WCSH-TV 6 Alive! offers a *Handbook for Public Service Organizations in Maine*. Call the Director of Communications for a copy (800) 464-1213.

Maine Television Stations

WABI-TV Channel 5 Bangor; 947-8321
WAGM-TV Channel 8 Presque Isle; 764-4461
WCBB-TV Channels 10, 11,12,26 (Public) Lewiston, Portland, Bangor; 783-9101
WCSH-TV 6 Alive! Portland; 828-6666 or (800) 464-1213
WGME-TV Channel 13 Portland; 797-9330
WLBZ-TV Channel 2 Bangor; 942-4821 or (800) 244-6306
WMTW-TV Channel 8 Auburn; 782-1800 or (800) CH8-NEWS
WPXT-TV Channel 51 (FOX) Portland; 774-0015
WVII-TV Channel 7 Bangor; 945-6457
Local Cable Companies

Planning Considerations

1. A public service announcement (PSA) is a good follow-up to any action project where students have a message for a wider audience. The PSA will be most meaningful to students after they have had first-hand experience with the subject addressed in the PSA. For this reason, it is recommended that a PSA be produced after the completion of an action project.

2. Decide at the outset what the production goal is for the project. If your PSA is designed for television air time, it will need to follow the directions in the Procedure for Developing a Successful PSA section very closely. If it is to be acted for the school community, it does not need to be as strictly tied to these instructions.
3. Consider taking a field trip to a radio station or TV studio to give students a better understanding of where the PSA will be going. Ask to listen to or see samples of other PSAs.

Procedure for Developing a Successful PSA

1. A public service announcement must be short and to the point. Therefore, the class should be able to answer two questions with five-word answers:
   • What do we want the audience to *know*?
   • What do we want the audience to *do*?
   The answers to these questions will help to focus the class energy throughout the project. The answers should both be contained in the PSA.
2. There are four different styles to consider:
   • Informational - tells the audience directly what they should know and do;
   • Humorous - may be entertaining, but the message in the PSA must be clear;
   • Testimonial - features one or two individuals who convey a personal message;
   • Dramatic - attempts to show an important message, rather than tell.
3. The group should always write a complete script for a PSA, describing the sound and image to be included in the segment. A sample form for this purpose is shown at the end of this description. (A PSA designed for radio broadcast will only need a text of spoken words.)
4. A PSA should be no longer than 30 seconds. It is okay if the segment is slightly shorter than this, but it cannot be any longer. If a narrator were to talk continuously at a normal speed in the PSA, he or she could fit approximately 65 words. This should be seen as an absolute maximum number of words for the script.
5. When the script is complete, try staging the PSA with student actors several times. Ask other students or teachers to watch the PSA. Does it:
   • make sense?
   • catch the attention of the audience? (A video must have powerful visual images.)
   • provide important information?
   • motivate the viewer to action?
6. Remember that if music is to be included in the PSA, *it must not be copyrighted.*

Producing the PSA

There are many different avenues for getting a PSA produced:

1. Use live student actors and present the message to the school community. If the class develops more than one PSA, this may be the best idea. Since each segment is only 30 seconds long, however, it may be best to present the announcement during some other event (e.g., at lunch time, before a school assembly). Sound-only PSA's can be read to the entire school during daily announcements.
2. Produce the PSA with an audio or video recorder. The tape can then be aired in the school or sent to other schools. This will require equipment and some significant production time, but is a valuable process. Editing capability will be very helpful.
3. Produce the PSA on video and submit it to your local cable station to be shown over the public access channel.
4. In the preparation of *Pathways to a Sustainable Future*, WCSH-TV has agreed to consider airing school PSAs. The station encourages schools to promote good ideas for waste reduction and student projects with Public Service Announcements. Projects will be considered for the 1993-94 and 1994-95 school years.

Public Service Announcement

The recommended procedure is to produce the PSA on videotape and submit it to WCSH-TV Channel 6 Alive! Deadlines for submission are March 31, 1994 and March 31, 1995 for that school year. The PSA will be considered by the station for television air time. It is important that all the guidelines in this action project are followed carefully for PSA's that are designed for TV airtime. In addition, the following preparations must be made:

- A cover letter must be sent with all materials explaining that the video has been produced in conjunction with the *Pathways to a Sustainable Future* curriculum.
- The video must be produced with the highest quality materials that are readily available.
- A complete script of the PSA must be included with thorough audio and video directions.
- All actors who appear in the video (or their parents) must sign a talent release (sample form included on the next page) and send it with the other materials to Channel 6 Alive!
- All materials must be sent by the deadline to:

Director of Communications
WCSH-TV Channel 6 Alive!
One Congress Square
Portland, ME 04101

If you submit a video to WCSH-TV 6 Alive!, you can expect to hear back from them whether or not your PSA will be produced.

5. Submit a completed script or a finished audio or video tape to other radio or television stations in your local area. Most broadcasting stations accept PSAs; however, they may wish to produce the segment themselves.

The Script

Name of Group _____ ***Subject*** _____

Address _____ ***Target Audience*** _____

_____ ***Begin Date*** _____ ***End Date*** _____

_____ ***Title*** _____ ***Length*** _____

Contact Person _____

Telephone # _____

Video	***Audio***
	End

Talent Release

I authorize [WCSH-TV, Portland (Maine Radio and Television Company), and WLBZ-TV (WLBZ Television, Inc.)], herein-after named "Producers" to make use of my appearance and/or voice on television and/or on radio prepared by the Producers.

I agree that the Producers are the sole owners of the programs thus prepared, and that I am entitled to no compensation of any kind arising from any recording, rebroadcast or other use whatever, whether commercial, non-commercial or educational, of my appearance thereon.

I further authorize the Producers to use my name, likeness and biography or resume material to publicize my appearance on the program developed from it.

I agree to indemnify and hold harmless the Producers, their officers, agents and employees, and their assignees, from any liability, loss or damage (including reasonable attorney's fees) arising out of or caused by any matter or material furnished or spoken by me in connection with my appearance.

I also agree that the Producers may provide this material to other broadcast stations for their use.

This contract should be governed by the laws of the State of Maine and New Hampshire.

_____
Dated

_____
Signed

_____
Signed by parent or guardian
if talent is a minor

Pushing for a Change

Overview

Students can change their behavior, create less waste, or work on a recycling program, but what can they do if they discover that a big part of their waste problem results from the way the school operates or the things it buys? Kids and teachers can't change school procedures by themselves. It may take a change in school policy to make a real difference. For this, they need the support of the school administration and the school board.

Political action isn't easy. Sometimes students and teachers need to push the system and help the "powers that be" understand how they can help reduce waste and work toward a sustainable future. Kids who present their ideas to make the world a better place are very compelling in front of the school board or town council. These "Pushing for a Change" suggestions can help them pull the right strings and push their idea through.

Ten Steps for Taking Action

No matter what your problem or project , there are a few steps that will help you organize a successful project. Barbara Lewis describes these ten steps in *The Kid's Guide to Social Action* (1991).

1. *Identify the issue.* Choose a problem that is important to the whole group and everyone can support. Don't just consider a problem that is easy to solve, but at the same time don't choose something that would overwhelm the group.
2. *Research the problem.* Find out as much about the issue a possible. Use books, newspapers, and experts. Survey people to see how they feel about the issue, talk with public officials on the phone or in person.
3. *Brainstorm possible solutions.* Brainstorming is a creative group process. Think of all the different possibilities and discuss them to refine your plan of action. Choose one or a few solutions.
4. *Get support for your project.* Find people who agree with you and get their support, build a coalition. Talk with parents and relatives, neighbors, other students, town officials, state agencies.
5. *Identify the opposition.* Who has different opinions or is against your solution? Listen carefully to find out how people really feel about the issue. Seek out your opponents and try to win them over. Listen to them to understand their side and appreciate their opinions.
6. *Advertise.* The media are usually enthusiastic about kid action. Use press releases and public service announcements to express your concerns or get your message out.
7. *Raise money.* This is not always necessary, but often having money can help you accomplish parts of the project much easier.
8. *Carry out the solution.* After getting all the plans in place, get to work. List the steps, decide who is responsible for each, and when each step will happen.

9. *Evaluate the progress.* How is the plan working? Are there things you should change? Do you need to talk to more people? Make it work!
10. *Don't give up.* Don't just accept everything people say about why your plan won't work. Keep at it until you find a solution that *will* work. If the issue is important, stay with it!

Changing School (or District) Policy

School policies are established by the School Board (School Committee, Joint Board, etc.) The Board makes the decisions that keep the schools running and control how the money is spent. Yet, if your students have a plan to get the school to reduce waste by 50% , you probably shouldn't go straight the Chairman of the Board. You need to go through channels to fit in with the system before you can expect to change the system.

Another complication is that school administrative structure varies widely throughout Maine, and the procedures can be very different. You should talk with administrators and attend Board meetings to get a first-hand picture of how things operate in your system. The following steps are general suggestions for developing an approach to making significant changes in the way things are done in most schools.

Research the issue

1. If a school policy (e.g. using disposables in the cafeteria) is at the heart of the problem, have the Principal discuss the policy with the students. Be sure the students understand why the policy is in place, how long it has been the policy, and what he or she sees as the obstacles to changing the policy.
2. If a school practice (e.g. buying non-recycled paper) is at the heart of the problem, have the Principal describe the reasons for the practice, and who makes the decisions to change it.
3. Have the Principal describe how students can influence school policy or practice.

Develop the action plan with the students

1. Prepare a written description of the plan:
   - What is the problem? How do you propose to solve the problem?
   - Why is this the best solution?
   - What are the obstacles you anticipate?
   - How can these be addressed?
   - What is the time frame for each step?
2. Anticipate all costs involved in putting the plan into action. Where might those funds come from?
3. Involve the Principal in the planning, or at least keep him or her informed about the project. Ask the Principal for advice about how to get Board approval.
4. Communicate with parents and get their support for the plan.

Schedule an appearance at a regular Board meeting

1. With the Principal's support, make arrangements with the Superintendent to have your issue put on the agenda at a regular meeting of the School Board.
2. Have students write a letter in their own words to the Chairman of the Board outlining their concerns and how they see the problem. This direct link to the Board from well informed students can be very compelling, and will alert the Board members to the sincerity of the appeal from kids and the care in which the proposal is being made.
3. Prepare your presentation for the Board.
4. Have parents attend the meeting to demonstrate community support for your proposal. Talk with the opposition to bring them to your way of thinking, or make some compromises to gain wider support.

Meet with the School Board

1. Have two or three students attend and make parts of the presentation. Consider making the presentation as dramatic, lively, and concrete as possible. The presentation should be less than 15 minutes long.

Pushing for a Change

2. You should clearly state the problem, your solution, and why your solution is the best alternative.
3. Conclude by asking the Board for some specific action (to review and change policy, approve the project, give support, appropriate money, etc.)

Follow through

1. Write a letter of appreciation to the Board and send copies to the Principal and Superintendent.
2. If the plan was approved, follow the procedures you proposed. Carefully stick to the time frame you outlined.
3. If the plan was not approved, help students appreciate the democratic process and the reasons why the Board did not accept the proposal. Discuss alternative actions. Consider a publicity campaign to further explore the issue.
4. Publicly recognize the contributions of the students, Principal, and Board at any event for the project or in written material.

Proposing or Changing a Local Ordinance or Law

After you have decided on your issue and researched the problem, you might decide that the solution is to pass a new law, or change an old one. But before tackling ordinances and laws, you need to know how your local government works. Towns and cities in Maine have very different procedures, and might require different strategies. Call the town clerk to find out who you should talk to about the process in your town. Use the information you get about local government to plan who you'll contact with your proposal and learn how much work it will be to get the proposal adopted.

Before you make your proposal to the local government, do all your homework (research) to make your case. A petition is not usually required to initiate the process, but you can make a very strong statement if you have your proposal supported by a petition with many signatures. When you are ready to get the town wheels moving, follow these steps.

1. Contact the appropriate town official. Call, write, or meet with the selectmen, town manager, town council, planning committee chairman, clerk, or whoever can help you get started. Explain the issues and solutions, make your case. Get more information about procedures, opposition, legal problems, etc. Have students involved as much as possible.
2. Build your coalition of support and attend meetings when the issue is discussed. Provide information from your research as needed.
3. The town will decide if there is a need for your proposed law, investigate to be sure it doesn't conflict with existing laws, and draft the ordinance in legal language.
4. The proposed ordinance may be presented at a public hearing, or a town meeting. Plan to testify or present your case as you would to the school board.
5. The town will act officially to approve or deny the proposal. This may be through the selectmen, council, or town meeting.

Town ordinances or laws proposed by students will receive the same (or greater) scrutiny as any other proposal. Your success will depend on your research and the coalition of support in the community. This can be a very difficult process, yet it can be one of the most rewarding for students and teachers alike.

Pathways to Action

Featured Teachers and Other Programs

Creative Programs in Maine Jr. High and High School classrooms and additional valuable programs available to Maine schools.

"Featured Teachers" is a collection of successful projects currently being implemented by Maine teachers in grades 7-12. These projects are just a small sampling of the activities developed by many teachers in many schools throughout Maine, but they are included to help spark ideas for other teachers who want to initiate projects in their own secondary classrooms. Projects can be designed after those listed here, but more than model programs, these descriptions are intended to provide information, ideas, and inspiration. Each "feature" has several components which may generate ideas for starting points and new projects in your school. Whereas many of the projects suggested in Pathways to Action are geared for Elementary and Middle School, the "features" focus on the secondary level.

The six teachers featured here developed a variety of programs in different school settings. They designed in-school activities and after-school sessions, short units and whole year projects, and worked their ideas into many different subject areas. They have incorporated interdisciplinary and skill-building activities, and each features a few innovative aspects. Each teacher has agreed to be a resource for other teachers developing similar projects. Teachers are encouraged to contact the "Featured Teachers" as they design their own programs. Contact information is included in each "feature".

Gail Adshead - Garbology Unit, Cape Elizabeth High School
J. B. Kavaliauskas - The Raging Recycling Riots, South Portland High School
Ernest Kozun, Jr. - Jr. High Recycling Program, Windham Middle School
Mary K. Wells - Household Hazardous Waste Warsaw Middle School (Pittsfield)
Sue West & Dave Leibmann - Solid Waste Student Service Projects, Maine Coast Semester Program, Chewonki Foundation, Wiscasset
David Wilkins - Student-run Summer Camp, Katahdin High School (Sherman Station)

Compiled by Jeff Schwartz for the Chewonki Foundation. Jeff is the former Education Director of the New Hampshire Audubon Society.

Pathways to Action Featured Teachers

Gail Adshead Garbology Unit

Related Pathways to Action Projects

- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Comparison of Waste Disposal Methods – Landfill and Waste-to-Energy*
- *Landfill Siting Investigation*

Subject: Environmental Science
Teacher Grade: 9
Project Grade: 9
School: Cape Elizabeth High School, Cape Elizabeth, ME , serving grades 9-12 with 450 students total.
Teacher Contact Information: Leave message at school (899-3309) or call at home in the evening (781-5509).

Summary

This is a 2-3 week unit for two levels of 9th grade environmental science students. The unit focuses on the history and current status of disposal strategies, and on personal decision making. Activities in the unit include comparing landfills, package designing, garbage sorting and analysis, and more. Materials needed are easily collected and very inexpensive. A creative assessment project using students as consultants for a fictitious town are also discussed and several pieces of useful advice are offered.

Class Format

Gail teaches this course for five 55 minute periods per day with classes of 14-22 students each (96 students total). Students meet 3 out of 4 days, for about 4 hours per week. Classes include both college prep and honors students. All students do the 2-3 week unit, but not necessarily at the same time. This allows for a variety of sequencing and preparation for different groups and levels of students. The unit can be done in any season, but a little advance preparation is needed in the winter.

Preparation

Gail began by improving her own background knowledge. *Garbage* magazine was very useful (see Resources), in addition to other materials. With the pace of current changes, continued reading is essential. She reviewed several curriculum or activity guides, but found most of the activities targeted for younger students. Gail feels that a basic unit can be planned in several hours, working with a colleague or resource materials. Some additional preparation is needed to plan the timing of hands-on activities, to gather needed materials, and to determine elements that may need to be implemented early on (*e.g.* planning for a compost setup or burying items for the outdoor landfill in fall for a winter unit). Gathering or saving materials ahead of time (package samples, types of plastic, etc.) is essential, and Gail tried out new activities ahead of time. After the first year, saving materials that students brought in provided plenty of items for future years. Some planning ahead of time with administration and custodial staff may also be needed.

Goals

Gail aims to initiate student awareness of disposal issues. She finds that students may have general awareness of the environment, but they often do not have specific knowledge of solid waste issues. She also tries to link this unit to other topics the class covers (*e.g.* energy, soils, water quality, etc.). Specifically, she wants students to understand how their daily practices and consumer choices are connected to issues of disposal. In addition, she wants students to extend those connections to the available community options and begin to understand how such large scale choices are made. Gail focuses on developing what she calls 'discretionary discriminating skills', to understand the advantages and disadvantages of all the options considered. This forces students to do higher level thinking— synthesis and analysis rather than memorizing.

Description

This unit explores solid waste in general, with coverage of four basic disposal strategies (landfilling, incineration, composting, and recycling). A discussion about source and volume reduction follows, and includes a specific focus on decision-making. Using

historical information and archaeology, Gail illustrates that the choices about disposal of solid waste have been very similar throughout history, despite their increasing level of sophistication. The way these issues are tied directly to the students' lives is highlighted, and the implications of personal decisions are considered. Current state-of-the-art technologies and decisions are explored. A balance of activity types is used to reach all learning styles. Gail begins the college prep class with math and solid geometry (volume), but keeps it relatively simple. For the honors class, she covers issues such as managing energy and water resources. This provides more technical background, and students are given more reading assignments that will require this background.

Some Sample Activities

"Landfills:" This is a simple control experiment for teams of 2-3 students, using one of two procedures chosen by the teacher. The outdoor version involves finding a duplicate set of 12 items, burying one set underground, and keeping one set in the classroom as the control. After several weeks or months, the students dig up the buried items and compare the stages of decomposition to predictions made in the beginning of the process. The indoor version involves using 2 liter soda bottles with the tops cut off. They are filled with layers of soil, several items being 'buried' and more soil. They are misted with water, and each has a thermometer inserted. Moisture and temperature are checked daily for 2 weeks, and decomposition is again compared to predictions. In general, enough decomposition happens in 2 weeks to make a useful comparison, although not as much as the underground method. Students often select more durable starting materials when planning the outdoor version. Both methods provide the information that decomposition is not as rapid as most students predict it will be.

Garbage Sort and Analysis: Working in teams, students collect, sort, and measure a specific type or amount of trash. Gail makes plans with the custodial staff ahead of time to save trash for their use (but asks them not to include bathroom trash). With gloves, rulers, etc. the students set up and fill containers for compostables, recyclables, reusables, incinerator materials, and uncertain items. They then calculate the weight or volume of each category and calculate the percentages for each. They record their observations and discuss the findings.

Reading Articles: Using *Garbage* magazine or other sources, Gail selects an article to be put on reserve in the library. Teams of students receive specific questions, instructions, and guidelines for taking notes and seeking information from the article, and are then asked to discuss various elements of the article, write up drafts, and present a final report to the class.

Package Design: Students go to the grocery store to find descriptions of their 10 'best dressed' and 'worst dressed' items. Some limits are set (use only one item in a category – e.g. a student can't use five pieces of fruit). Students present their descriptions in class for discussion. Other students share their agreement or disagreement, and point out characteristics that the presenting student may not have thought of (e.g. that the item is paper, but coated with plastic, so not recyclable). This allows discussion of the pros and cons of each item. In teams of two, they then pick one item for which they want to redesign the package (several students will buy and bring in the item they are redesigning). Gail supplies many containers and craft materials, and students bring in other items from home, as they are given 2-3 days to complete the project. Each team must provide a drawing, build a prototype, and explain what they wanted to change and how the new plan addresses those goals. They present the new design to the class, and are rated on whether it is a workable improvement, how environmentally friendly it

Gail Adshead

is, and whether people would really use it. This is usually done as the last activity of the unit, as source reduction is discussed after all disposal options are covered.

Teacher and Student Roles

Several types of learning and activities are used, so Gail spends some time in a traditional way disseminating new information. She spends some time posing questions for which she does not have an answer, and some time facilitating student activities. Student roles include that of passive listeners as well as 'note takers', team members , lab partners, and active participants.

Assessment

As a test on the entire unit, Gail creates a fictitious town in Maine, describes the population, area, businesses, land use, and information about soils. She says the town is closing its landfill (following regulations), and they need a 'garbologist' to advise them how to become a state-of-the-art waste disposal town. Students may use any readings, strategies, or activities, to develop a plan to improve disposal options. Honors students write a take home essay in 4-5 days. The process begins with brainstorming in class, and students may bring in ideas or rough drafts ahead of time if desired. Gail has broken the assignment up into smaller pieces for other students. She has them work on it in teams, or has guided students through it a bit more herself. Gail has also asked students to write a fact sheet or brochure to be handed to supermarket shoppers, explaining what source reduction is, and why they might want to practice it.

During the unit, short tests or essays are often used as checkpoints. One example is a test in which students must fill in a grid with disposal options and provide 2 advantages and 2 disadvantages for each, with a prognosis for the future.

Resources and Materials

Most materials used are commonly found, or borrowed from a typical science lab. Approximately $60 in materials are required for a worm composting project, and the other activities require very few other materials.

Constraints

Field trips are difficult to schedule and to fund. While several great facilities were very close to the school (transfer station, waste to energy facility, regional processing center, etc.), such constraints prevent them from being utilized.

Elements of Support

Gail has tremendous support from her administration and department. This allows her to implement several projects that involve using the school grounds, digging holes, and building things. The town recycling committee is a great resource. They were able to advise her as well as to field questions from students.

Most Successful Aspects

Gail is most pleased with the way the unit integrates current environmental management issues. The garbology unit motivates students, holds their interest, and makes good real-life connections. It offers ample opportunities for hands-on activities and laboratory experiences. Gail is most pleased with the source reduction section and the hands-on landfill lab. While it is merely a rudimentary model of a landfill, the results are dramatic and have a serious impact on the students.

Aspects that Could be Improved

More connections need to be made with the compost program that the town recycling committee is developing. The committee provides education and support to the community about composting, and there are many opportunities to tie this in more closely with the student programs.

Advice to Other Teachers

Gail's primary advice is to find out what is happening in the town- what are the disposal options, what facilities exist, what programs are in place, is there a recycling committee? In addition to giving the teacher important background, it can also generate contacts and resources that can help with the unit. Secondly, teachers should think about how they will 'hook' the students. She often asks students to make a list of all they've disposed of since they got up that morning, and a second list covering the previous 24 hours. While most students assume it will be a short list, a discussion helps them see that there is much more disposed of than any one of them thought. Lastly, students in younger grades or concrete learners may need something to take home, such as a packet or notebook to organize their materials, handouts, activity directions, and notes. It may be helpful to give them copies of readings instead of putting them on reserve.

Expansions

Gail can easily picture future activities that lead students to develop permanent programs for the school, involving significant peer review and monitoring. Such activities may include composting from the cafeteria, teaching peers or younger students how to bring more environmentally friendly lunches, or monitoring recycling programs.

Pathways to Action Featured Teachers

J.B. Kavaliauskas
The Raging Recycling Riots

Related Pathways to Action Projects

- *Classroom Source Reduction Campaign*
- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Classroom and Office Paper Reuse Campaign*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Cafeteria Composting Project*
- *Letter Writing for Results*
- *Publicity*
- *Public Service Announcements*
- *Pushing for a Change*

Subjects: Biology, Chemistry, Earth Science
Teacher Grades: 9-12
Project Grades: 10-12
School: South Portland High School, S. Portland, ME, serving grades 9-12 with 950 students total.
Teacher Contact Information: Call her at school (767-3266) or write to S. Portland HS, 637 Highland Ave., S. Portland, ME 04106.

Summary

A proposal from one student's independent study project led to a Chemistry class' decision to organize and implement a paper recycling program for the school, along with many other activities. It also provided the topic and focus for the teacher's special project on process and skill-building. The program was carried into the next year in an entirely different context, without the process and skills focus, and with many fewer students participating. The project may change back to its original form in the future.

The Beginning

The project started when a senior student needing one more science credit to graduate developed an independent study project with a Technology teacher. The student proposed to research and conduct a feasibility study for a paper recycling program at the school. The result was a carefully written one-page proposal that was submitted to the principal and to J.B. J.B. was impressed with the proposal and thought it could work in nicely with a graduate school project she was planning on student skills and group process. She felt it best suited to an upper-class audience, and so decided to give the next year's Chemistry class the option to develop the proposed project.

The Initial Year

J.B. made the offer in September and the students accepted the challenge. The project was entirely student directed and managed; a priority for J.B. The students contacted various recycling companies to see if they would serve the entire school. The final arrangement was worked out with Waste Management of Maine, Inc. Students did all the letter writing, calling, planning, and contacting. They did the scheduling for pickups and collections, and communicated with faculty and students. They had one period (approximately 40 minutes) per week to do the actual collections from all classrooms and other areas of the school. If bins had not been placed outside the classroom, the students were not to interrupt classes to get them. The students had to look through the bins to make sure that only paper was sent to the collection company, and many contaminating items were found. Communication skills were especially important (*e.g.* working with outside companies, communicating with the school administration, faculty, and students).

Serving as a coach, J.B. occasionally presented students with 'to-do' lists. She also prompted them, and reminded them of specific tasks, deadlines, memos or letters needed. She also asked what else they might want to do, how far they wanted to carry this project, and what additional activities they wanted to include. They decided to create an educational program for elementary students, designing two games on recycling, developing a comic book, and doing 7 actual programs at the elementary school (for grades 1-5). They did all the contacting, scheduling, and delivery of these programs, while keeping logs of their activities. They received very positive feedback directly from the elementary teachers, who wanted to keep the games for future use.

No payments were received for the recycled paper, so any funds had to be raised from other activities. They made and sold sweatshirts with their own logo, and wrote letters of request to several companies, a few of whom responded favorably. They spent

some of these funds on materials for the games, copying, and buying the logo. Other activities included keeping records and supplying reports to the school every 2 months with information about the tons of paper recycled and number of trees saved. They arranged for a few guest speakers from local corporations or organizations involved in waste issues to address the class. A few students occasionally went to visit other organizations or facilities and presented reports to the rest of the class.

J.B. spent time with the class addressing such issues as how to make formal phone calls, and write business letters. While there were occasional problems with students missing certain rooms or talking too much in the halls, the issues were discussed and the process became quite smooth. As some students left the school, replacements had to be found. Some of the more active students felt they were doing too much of the work and it was sometimes described as 'pulling teeth' to try to get the whole group to participate fully. They talked about those issues, kept logs of who was doing the various tasks, and did self and peer assessment.

J.B.'s initial goals were specifically focused on skills and process, and the recycling program was simply a useful vehicle to accomplish those goals. J.B. felt that an environmental topic would be useful for such a purpose and well received by the students. The school did not have a recycling program and many of the students recycled at home, so there was an awareness and a need. Administrative support was strong, allowing students substantial freedom to be off school property often making contacts and running errands using their own cars. They received some support from Waste Management of Maine, who occasionally sent encouraging letters. Constraints were limited to occasional transportation problems and student reluctance over time to keep the project going. Assessment was focused more on the process and skills. The recycling program had 'built in' benchmarks for assessment, including whether the paper was getting picked up, the quality control of contamination, and how often problems were reported. Regarding the process and skill elements, regular consultations were held with J.B., and self evaluations were done. At the conclusion, students wrote a paper in a newspaper story format, letting the public know what they accomplished and the skills they learned.

At the conclusion of the first year, the students were required to write a proposal to the next year's class, including recommendations, what worked well and what didn't. They also left files, letters, computer disks, and previous records for the next group, as well as some leftover funds.

The Second Year Transformation

The next year's upper-class audience was a Biology class, and they were also given the choice to take on the project or not. The response was not unanimous, and J.B. decided to let eight students take on the entire project, while the rest of the class was uninvolved. This time the focus was on the recycling program alone. J.B. talked with the interested students in September about the commitment they were making and how important it was. J.B. gave them the information from the past year, a map and list of what needed to be done, and they developed a structure and schedule. The participating students got out of one class per week to do the collections, but there were no academic incentives, credit, or special recognition. J.B. designed the weekly class schedule with this in mind, planning lighter workloads for recycling days, and only occasionally requiring the students to make up missed class work.

The students polished a few aspects of the program, doing more checking for contamination in the beginning, making lists and communicating with teachers. At one point the program received a strong warning from Waste Management about the level of contamination, and the students put out a strong memo to all teachers, with good results. They used the files and information from the previous year to generate letters

J.B. Kavaliauskas

and memos, and to make contacts. The process became routine, and it went smoothly most of the year.

The differences in the program were very apparent. Class time was not spent on the recycling issues, and no additional activities were pursued (guest speakers, field trips, education programs). Also, there was no time to spend with the students on process and skills issues. The program was still student-run with a sense of ownership by those students participating, and the students again wrote a proposal for the next group.

The Uncertain Future

J.B. has no upper-class courses in the 1994/95 school year, and this complicates the plans. She has considered using a study hall group to accomplish the tasks. This could involve rotating schedules so any given student would have some time for study and other time for the program responsibilities. This group would, of course, still get to read the proposal and make the decision about participation. If possible, J.B. would like to spend more time with the students, and include more emphasis on the skills and process elements.

Resources and Materials

Very little is needed in the way of materials or equipment, aside from bins in the classroom. Waste Management supplied four big bins. Speakers were free, and the few students participating in field trips provided their own transportation.

Most Successful Aspects

The students' responsibility and consistency, developing routines and structures, handling a large building, keeping to Waste Management standards, and following-through were all highlights of the program. The process and skills work was very successful in the first year, and rewarding for both the students and J.B. (developing skills in follow-through, communication, getting along with each other, and improving group dynamics).

Aspects that Could be Improved

There is a need to spread responsibility and improve communication between students and faculty. In the second year, more time was needed for group skills. There was not enough work for an entire large class to do, so a plan would need to be developed for a smaller group so the teacher could spend adequate time with them.

Advice to Other Teachers

J.B. feels strongly that the success of the program in both of its very different forms was due in large part to the ownership by the students. Giving them the information and letting them make the decision was crucial. This project began with student initiative, so corollary advice would be to give serious consideration to student generated projects and proposals.

Expansions

Future programs could expand to include more items for recycling, such as bottles, cans, and other types of paper. Also food packaging in the cafeteria could be addressed. With student interest, many other options could be pursued (more education programs, speakers, trips, or other events and projects).

Ernest Kozun, Jr. Junior High School Recycling Program

Subject: Technology Education
Teacher Grades: 7-9
Project Grades: 7-9
School: Windham Middle School, Windham, ME , serving grades 6-8 in '95 with 650 students total.
Teacher Contact Information: Leave message at school (892-1820).

Summary

This project is a student-run recycling program for paper, cans, and glass. It takes place before and after school, and raises approximately $1,000 per year. The student recycling committee has regular meetings, discusses the goals each year, and decides on the allocation of the funds raised. Student ownership and leadership skills are thus a major part of the program. Ernie Kozun initiated it, and serves as faculty advisor to the program.

Preparation

This is mostly a student-run program attracting several 'veteran' students each year, so there is minimal preparation needed. Ernie puts together the agenda for the first meeting and prepares information and handouts for the students (including those on leadership, process, and goals & objectives).

Goals

The principle goal is to manage recycling at the school. In addition to the logistics and organization of the recycling, each group discusses the basic rationale and writes down goals and objectives for the program at the beginning of the year. This happens even if there are several returning committee members. Decisions about distribution of the funds raised (see below) also provide ideal opportunities for discussion, group process, compromise, and a host of other important processes and activities. The establishment of student ownership and building leadership skills are essential elements of the program. Using some handouts from the Maine Energy Education Program, the group makes decisions with everyone's input to keep the program running smoothly for the entire year.

Description

The program began on Earth Day 1990, and has continued consistently with great success. This program is not a part of any class or the formal school program. All the planning, meetings, discussions, and the actual recycling happen before or after school. Recycling may involve 15-20 minutes during homeroom, or a 45 minute block after school. Activity periods that used to occur once per week and were used for this program are no longer part of the school day. Students meet an average of 4 times per week to work on some aspect of the program. A recycling committee is formed from those students who respond to various recruitment efforts in the beginning of the year, including general school announcements, specific information presented by Ernie to his own classes, and some assistance by other teachers. The committee typically includes students from all three grades in the school forming a type of 'feeder system', with older students serving as trainers for the younger students. The students who join the committee during their first year in the school usually do stay with it for the next 2 years. The size of the committee has ranged from 4 to 10; 8 is ideal. In early meetings, the group discusses appropriate procedures for distribution and collection of the bins. In past years, Ernie has also taught an elective environmental issues class, and included various aspects of the recycling program in that class.

The students collect bins for white paper and newspaper in each classroom and office once every week or two. The students divide

Related Pathways to Action Projects

- *Cafeteria Source Reduction Campaign*
- *School Source Reduction Publicity Campaign*
- *Classroom and Office Paper Reuse Campaign*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*
- *Publicity*
- *Public Service Announcements*
- *Pushing for a Change*

Ernest Kozun, Jr.

A sample of teacher projects that have been funded

- *Purchase of storage bins for additional recyclable materials in the Home Economics Dept.*
- *Purchase of materials to construct compost bins for an Environmental Issues class*
- *Purchase of a sample solar vehicle, video, and solar cells for students to build them in Manufacturing and Technology classes*
- *Copying, binding, and supplies for students to design and illustrate children's story books dealing with environmental issues, for ages K-3*

up responsibilities during their work time, and keep a record of their collections. The paper gets dumped into much larger bins that are kept in the technology education storage area. Students sort the paper and check for contaminant materials that are not recyclable. The larger bins are collected twice per year by a local broker. The other schools in town also have recycling programs, and it is arranged for the custodial staff to bring their accumulated paper to the Middle School for pickup on the same day.

Cans and bottles are collected in the cafeteria. They are picked up by a local redemption company as scheduled by Ernie (usually once per week). The school is paid 6¢ each, generating approximately $100/month.

There are various incentives provided to the committee for participation. Once each year in April, the committee takes a full-day field trip to Augusta. After being treated to breakfast, they spend the morning participating in the Page for a Day program at the State House. Ernie feels this ties the ownership and leadership components of the recycling program very nicely to the larger picture, and the students enjoy it. In the afternoon they participate in one additional activity, such as meeting with staff from the Maine Waste Management Agency, meeting with their own local legislators, or visiting the State Museum. Ernie occasionally brings in doughnuts or other treats, and provides lunch during the two paper pick-up days each year.

Distribution of the Funds

The funds generated by the program provide many opportunities for the students to discuss and decide important issues. Ernie likens it to running a small business with partners, and encourages all students to participate and be consulted for important decisions. The group discusses a range of activities and makes their plan for the year. The incentives provided to the committee are all paid out of the funds raised, after consensus is reached. Each group starts the year with approximately $500 in the account, and leaves the same amount at the end of the year for the next group. Sometimes the committee receives requests from the community to provide funds for other projects like a teen center. Ernie insists that a significant majority of committee members be present in order for funding decisions to be made.

In some years the primary distribution of funds has been through a grants program for teachers at the school (usually allocating $500-800 per grant). Using a sample form from the State, the first group developed their own application. The application states that "programs educating students, parents, and/or staff about environmental issues will be looked upon favorably." They requested a 1-page proposal from the teacher, with a maximum award of $200. They all received copies of the applications for discussion, and Ernie made sure that everyone understood the projects. If the students have questions about an application, one of the students interviews the teacher and reports back to the group. The committee has awarded partial grants in some years in order to fund more teachers.

In other years, a different approach has been taken. In 1993-94 the 7th grade attended a special Adventure Week program at Otter Pond Camp with outdoor and challenge activities and one overnight. While parents paid most of the cost and the school paid a portion, several students could not raise the required funds. The recycling committee sponsored about 15 partial and full scholarships for this activity (approx. $450). In exchange for receiving this funding, the students were required to sign a contract and to put in work during 7 recycling 'meetings' for each $25 in assistance they received.

Teacher and Student Roles

As faculty advisor, Ernie puts together schedules, arranges pick-ups, keeps books, does paperwork and permission slips for the field trip. After the first couple of years, he found that most items had been put onto the computer, and required only minor changes.

Most of his effort is as a facilitator to the program, and as a guide to help students understand their limits .

Students are very involved participants and decision-makers. Older students occasionally have the role of teachers for the new students on the committee. Specific students take on leadership roles associated with a project they are pushing or with an application from a teacher they know well.

Resources and Materials

Very little is needed, and the items with the highest cost (bins for the rooms, etc.) were funded out of the money generated by the program. Initially large cardboard boxes were used instead of the plastic bins.

Constraints

Aspects that make the project more difficult include the elimination of the activity periods during the school day. Finding times for the entire committee to attend meetings is difficult. Meetings that require most to be there (*e.g.* funding decisions) requires extra planning, footwork, and compromise. Also, lack of adequate storage room for materials awaiting pick-up is a problem.

Elements of Support

The school administration is very supportive and gives Ernie very wide latitude. He also finds that having brokers that are reliable and on-time for pick-ups is very important.

Most Successful Aspects

The student ownership and leadership roles are very successful and satisfying to observe. The program has been ongoing and successful for several years, and it is helpful and rewarding at the end of each year to review with the students the written goals and objectives developed at the beginning.

Aspects that Could be Improved

Ernie has considered a few specific factors for continued success: Expectations are kept reasonable and students are not pushed too far given their age and the time they have available. As facilitator, he makes sure that goals are reasonable and attainable to avoid disappointment and discouragement.

Advice to Other Teachers

Primary pieces of advice include:

1) getting the total support of the administration very early in the program's development (get startup funds for containers if you can);
2) go to observe a program in operation, as it will answer a lot of questions. Bring several students if possible and have them talk to students already involved at another school.
3) Don't try to start too big- keep the goals reasonable and small. You can always enlarge them later if all is going well.

Expansions

Ernie and the students have talked about working with a town recycling group to do paper recycling in small businesses. The idea was thoroughly discussed, but the students decided that they did not have the time, resources, and energy to manage the expansion. The group could do more with the cafeteria, check for other materials that could be recyclable, and keep more detailed records of amounts recycled. They could also survey the level of participation and the percentage of recyclables actually recycled.

Pathways to Action
Featured Teachers

Mary K. Wells
Household Hazardous Waste

Related Pathways to Action Projects

- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*

Subject: Health, Home Economics
Teacher Grades: 5-8
Project Grade: 7
School: Warsaw Middle School, Pittsfield, ME, serving grades 5-8 with 390 students total.
Teacher Contact Information: Leave message at school (487-5145) or home (453-9665).

Summary

This unit focuses on household hazardous waste as part of a health/home economics class for 7th grade. Elements include definitions of key terms, home surveys, alternative recipes for many products, proper disposal, and recycling. Much of the work is done with work groups based on cooperative learning goals. Ideas for expansion of the program provide additional opportunities.

Class Format

This course meets for the entire year once per week for a double period of 90 minutes. Mary has 6 groups in 7th grade, with 20-24 students per class. All 6 groups do the unit at the same time of year. The Household Hazardous Waste unit takes 5-6 consecutive full classes to accomplish. While fall has been used successfully for this unit, any season would be suitable, and Mary has future plans to move it to spring to coincide with Earth Day.

Preparation

Very little preparation is needed for the unit. Sample empty containers and other materials can be saved or collected, and kept for use in future years. Preliminary outlines of the unit with tentative daily schedules and activities are produced during the summer. Initial planning and coordination will need to be done if other teachers will be involved or field trips included.

Goals

The goals for this unit include having the students develop an awareness of what is hazardous, become aware of such items commonly found in the home, develop the skills and knowledge to effectively read labels, and learn how to properly use and dispose of such materials.

Description and Activities

The unit begins with an introduction to what makes things hazardous. Students are given five categories (*e.g.* automotive, cleaning, paint) and brainstorm products that they feel fit into each category. A current news or magazine article about a household hazardous waste problem is read and actively discussed in class. Definitions of key words such as toxic, corrosive, flammable, and reactive are presented and discussed.

A letter is sent home to parents to inform them of the next activity, which involves students conducting a home survey of hazardous products. For homework, the students fill in four sections of a handout labeled kitchen, bathroom, supply closet, and garage/workroom. For each, various items are listed and students check off those found (e.g. 'oven cleaner, floor cleaner, scouring cleanser, bleach, ammonia, drain cleaner, other' for the kitchen section). They then take two products and answer 8 questions from a handout (such things as why this product is hazardous, whether its label lists storage and disposal directions, if there are health precautions suggested, if any terms are unclear, whether the product is currently being stored correctly, etc.). They are also asked to list the first three ingredients, and to consider calling the toll free number if one is given (but only if they have a specific question). These sheets are reviewed the next day in class, and students do a similar activity with a box of empty containers supplied by Mary. Another activity involves student groups getting cards with situations described, and they have to decide and all agree on whether the material

is toxic, corrosive, reactive, or flammable. Advertising techniques used by sample products are discussed as well.

Disposal issues are discussed, and the pathways of garbage and toxic materials being disposed of are considered. Students learn about and discuss the process of leaching and the various potential environmental effects. They become aware of the various systems at work in their own community and home (whether they have town water or wells, town sewers or septic systems, if there are dumps, landfills, transfer stations, recycling options, etc.). How materials disposed of effect other parts of the environment is also discussed. Terms such as parts per million are defined and discussed in relation to allowable human tolerances of various chemicals, and students consider how substances can enter the human body, reviewing information learned in lower grades (inhalation, ingestion, absorption).

Then various alternatives are discussed and recipes are provided. Students are asked what alternatives are already being used, discuss new ones presented by Mary, and try out two of them. For one, Fantastic cleaner is compared with baking soda to clean table-like desktops. Students are allowed to write on the desktops with pencil, and then both methods are used to clean them. They evaluate how each cleaned, how convenient it was, the advantages and disadvantages of each, etc. The second trial is with Windex window cleaner and a solution of white vinegar and water. Large windows in the school lobby are used, with sections taped off. Again the two products are evaluated, and students are polled on which product they would use and why. The advantages and disadvantages of each, and the problems that may be caused by each, are discussed and the tie is made to purchasing decisions based on personal values.

Recycling is also discussed as a part of this unit, with a video shown, and a big list is made with a brainstorm of 100 things that could be reused, recycled, have their lives extended (*e.g.* scraps of cloth for projects, plastic containers as planters, etc.). All students are required to contribute at least one idea. Students are told to bring in ideas and also to bring actual examples of such items for extra credit.

At the end of the unit all students create a poster to reflect a home of the future. They focus on any part of the unit they choose, and create what they think a good home of the future will look like (*e.g.* easy ways to recycle, disposal systems with chutes to suitable collection sites).

Teacher and Student Roles

Mary tries to vary the learning activities as much as possible, including more traditional lecture, use of audio visuals, active projects and home assignments, and quite a bit of group discussion, decision-making, and reporting. In her classroom, there are 6-person tables rather than individual desks, thus enhancing such group projects. Many of her efforts are spent as a facilitator of these small groups and cooperative learning activities. In addition to participating in the activities, students keep notebooks and are allowed to use them during a test at the end of the unit.

Assessment

Students are assessed on the inventory they do at home, the poster, and the final open-book test. Each week students are given checks, with pluses and minuses, reflecting their behavior and efforts. This also includes an assessment of their cooperative or group work, and process skills.

Resources and Materials

The materials needed for most activities are quite easily obtainable and inexpensive. Several activity ideas have been gathered from the book 'Teaching Toxics' published by the Association of Vermont Recyclers (see Resources). Other information and inspiration was gained from a course entitled 'Pollution Prevention' taken at the University of Maine at Orono. Videos, fact sheets, and other materials have been used from the Maine Waste Management Agency (see

Mary K. Wells

Resources), and from other organizations, including the University of Maine at Farmington resource center and the Washington Toxics Coalition (4516 University Way NE, Seattle, WA 98105). A few innovative health books have been helpful, and several cooperative learning workshops have been offered at the school, encouraging such activities.

Constraints

Having the students for only 1 class per week is very limiting in many ways. Also, having the same class to offer 6 times with different groups is difficult- keeping consistency is especially challenging. A continuing constraint is the simple lack of time to devote to this unit, and the necessity to pick and choose among the many ideas and activities that could be offered.

Elements of Support

The administration is very supportive, as are colleagues. The length of the class meetings is an advantage (despite their infrequency noted above), and the topic is one in which the students are easily interested. The two science teachers in grades 7-8 have also expressed their willingness to assist with expansions of the program in the future (see below).

Most Successful Aspects

The most successful activity is reading labels and looking into alternatives. Students are very interested in these options, and they can take the information and experiences home to implement them immediately.

Aspects that Could be Improved

More work needs to be done with proper disposal, including field trips, etc. (see expansions below).

Advice to Other Teachers

Keep the unit small to start with, and don't wait until all the plans are totally refined before starting. Jump in and adjust as you go. Mary suggests clipping the local newspaper for articles relevant to the unit, as they help make it real and relevant for the students. It may also be helpful to brainstorm a list with the students of what their concerns are and use that to begin.

Expansions

There are many opportunities for expansion of this unit. Mary already has plans to work with the science teachers next year to present activities focusing on visible characteristics of the terms already discussed; corrosive, reactive, flammable. With several learning stations, the students will experience such things as nails in copper sulfate, adding baking soda to vinegar, etc. For each, they will record their observations and theories of what is happening, and answer such questions as 'how would you define corrosive?' and 'based on these results, would it be dangerous for such substances to enter a landfill?'

Field trips to the local transfer station or other facilities would also be extremely useful. Mary has ideas for a project in which students would write a brochure for local towns telling residents where various items can be taken for recycling or proper disposal. Involving the students with younger children is also an activity she hopes to pursue, and she has ideas to integrate other aspects of her own curriculum with a project using donated fabric to have the students make cloth lunch bags during the sewing unit.

Sue West & Dave Liebmann
Solid Waste
Student Service Projects

Subject: Environmental Issues and Ethics
Teacher Grade: 11
Project Grade: 11
School: Chewonki Foundation 'Maine Coast Semester' Program , serving grade 11 with a total of 34 students per semester.
Teacher Contact Information: Leave a message for Sue West at Chewonki (882-7323).

Summary

The Maine Coast Semester is a residential program held each fall and spring for 34 eleventh grade students from public and private schools around the country. 'Environmental Issues and Ethics' is an elective course that runs for the entire semester, and the Environmental Service Project is conducted for 6-8 weeks of the course. Once given a topic, groups of students choose a project to research, plan, and implement that provides a service to an individual or an organization. Many processes and skills, such as researching many sides of an issue, working in groups, and creating presentations are also major parts of the project. In the early 1990's, the major topic of focus was solid waste management.

Class Format

The course has a range of 8-14 students, and meets for a total of 5 hours per week, with a 2-hour block on one day. This longer period is used for field trips to sites within 30 minutes. The 6-8 weeks devoted to the Environmental Service Project allows students to do adequate research during class time, plan for telephone calls, and complete other tasks. An additional teacher may be involved during the project time, which provides great opportunities for collaboration, support, and brainstorming. Each group with 4-6 students has a teacher as an advisor.

Preparation

Project ideas, needs, and potential recipients of service projects are researched prior to the beginning of the semester. Individuals or organizations like a town recycling committee are told about the length of the project, that it must be educational, and a priority for the individual or organization. Finally, they are asked if they enjoy working with high school students. The students select projects from a range of choices, so no promises of student involvement are made during this planning stage. As potential projects are brainstormed, it is helpful to consider specific equipment needs that might be required.

Goals

The overall goal is to research a local environmental issue in depth and from several different viewpoints in order to provide a service to an individual or an organization in the form of positive action. Specific elements of that goal include:

- to design and plan a service project, including all of the logistics and potential complications
- to carry out a thorough, well rounded investigation
- to learn valuable ways to work as a team, dealing with difficulties, and improving effectiveness
- to learn about communicating well with the recipient of the service project
- to learn to evaluate oneself , one's group, and the project

Sue wants to see the students so well versed in the subject that they can be conversant with someone in the field. She is also interested in encouraging students to research, learn, make decisions, and then take action, not 'sitting on the fence' for too long.

Related Pathways to Action Projects

- *School Source Reduction Publicity Campaign*
- *"Junk" Mail Reduction Effort*
- *Used Clothing Drive and Swap*
- *Magazine Reuse Campaign*
- *School Recycling Program*
- *"Buy Recycled" Campaign*
- *Cafeteria Composting Project*
- *Promoting Alternatives to Hazardous Products*
- *Waste Paint Exchange Project*
- *Battery Use Reduction and Rechargeable Battery Promotion*
- *Letter Writing for Results*
- *Publicity*
- *Public Service Announcements*
- *Pushing for a Change*

Sue West & Dave Liebmann

Some sample projects

- *Developed and produced a paper tray liner for Arby's. "Recycle Land" was a game about Maine's solid waste crisis, played with a few coins on the place mat.*
- *Produced a booklet focusing on recycling and composting, designed to present the basic steps to youth camps in Maine.*
- *Designed and implemented a study on cloth recycling for a local recycling center. This involved sorting, counting, weighing, and finding markets or uses for many types of used clothing.*
- *Conducted a survey about Maine's laws regarding the use of paper and/or plastic bags by grocery stores. Students observed the store operations, interviewed shoppers, and wrote a report about adherence to the law. This report was submitted to the Maine Waste Management Agency and was referred to by them in a report to the legislature.*
- *Produced a brochure as a consumers' guide to reducing waste, with home and shopping tips, and contact addresses and phone numbers for more information.*
- *Produced a video for younger students showing the path of a piece of paper going through the recycling process, involving visits to a recycling plant for actual footage.*

Description

The Environmental Service Projects are chosen by groups of students after careful consideration of alternatives. The teachers present some of their ideas and assist further student brainstorming. Students are also told what past groups have done. Categories such as writing a pamphlet, producing a video, writing and performing a play or song, working with younger students, or crafting something, are suggested. Students are told about some potential recipients of service projects who may have been contacted earlier. If interested, students then call them back to discuss the potential project further and often invite them to make a presentation. Good presentations by outside speakers definitely tend to generate more student interest.

After these initial presentations, students consider various elements and make a choice. While the teachers want to give students as much choice as possible, they also retain the right to make final approvals, to assure that students don't pick a project whose scope is so large that successful completion is unlikely, or one that is inappropriate in some other way. Projects must proceed from knowledge to action, they must be educational, and outside activities must be within 30 minutes drive. Finally, the number of groups and projects in any one class depends on the amount of supervision available.

The main issue studied in the course is one that is currently in the news. One of the objectives for the research that the students do is to find alternatives to traditional library sources. Thus they work with newspapers, call journalists and key people of all types, contact organizations, agencies, and businesses. Work is also done in class, and handouts are provided on elements such as how to ask better questions when doing phone calls or interviews, planning presentations, public speaking, and the use of visual materials.

Teacher and Student Roles

The teachers bring ideas and suggestions to the students, trying not to influence the selection of projects. Quite a bit of coaching is involved, especially helping the students generate many possible ideas. Student group process is observed and teachers go to meetings of all the groups. The teachers sit outside the circle and are not the first ones to speak. Their contributions are carefully worded so they are not seen as overbearing.

Student roles include those of learners and note-takers when basic information and background are presented. Yet even much of this information is presented in creative formats: using guest speakers, field trips, and student-lead discussions. In preparation for student-lead discussions, students are given articles to read, and they are told that names will be drawn at each class meeting to see who leads the discussion that day. Sue and Dave do not speak for the first 20 minutes, and though the students are nervous at first, they learn to manage the discussion effectively. Sue and Dave help the students refine their discussion skills by paying particular attention to process, time management, facilitating, and dealing with tangential issues. Students seem more prepared to participate in discussions being led by other students than those led by the teachers.

Assessment

Evaluations occur at two main points during the project, based on a combination of teacher comments and student self-evaluation. Students are presented with a potential evaluation form containing questions about their activities, behavior, and learning. Questions are asked about the student as a leader, as a team player, how well they integrated materials, and their efforts and energy they put into the projects. The forms are used midway through the project and at the end. Students may also choose to evaluate each other if the group agrees on that option.

Resources and Materials

While certain books or guides are always helpful, the best resources have been people, including town and state agency personnel, recipients of service projects, legislators,

journalists, those in private companies, and others. Newspaper articles have been very useful for current events and as sources of contacts to pursue for more information. Various national organizations have been good sources of background and technical information (see Resources). In terms of equipment, the two most useful items are telephones and computers with good quality printers (for production of brochures). Guest speakers and field trip facilities have been free, so transportation has been the only cost.

Constraints

The projects are often constrained by scheduling conflicts. Recipients of service projects and students may find it difficult to schedule a meeting due to conflicts with other classes. The same is true for phone calls and field trips. Some recipients are too relaxed, uninvolved, or not willing to work with the students, while others may be too involved or overbearing (perhaps wanting to do too much of the work themselves). Any projects which involve working with the legislature are difficult because very short notice is often given for hearings, and because legislators need specific information quickly and can only receive it during a short time.

Elements of Support

Tremendous support is provided by the administration, colleagues, and from many other sources. They have found newspapers, TV and other media to be very interested in coverage for student activities, especially if the topic is particularly 'hot' in the local community. Useful support has also come from local and state agencies (such as the Maine Waste Management Agency, the Dept. of Environmental Protection, and the County Recycling Office) who have fielded student questions, provided information, and referred them to other sources. The Maine Organic Farmers and Gardeners Association has provided information about composting, and Regional Waste Systems in Portland has also been very helpful as a field trip destination, for guest speakers, and as a source of information. Legislators have been receptive and helpful as well. On occasion some funding has been obtained from businesses and corporations, including in-kind donations to support a specific student project. In general, those individuals and businesses who have been recipients of service projects have been tremendously supportive and have played a key role.

Most Successful Aspects

The experience is most successful when the projects are going smoothly! The students feel excitement by becoming well informed, and providing a useful service to someone. The self confidence and pride generated by the projects is substantial.

Aspects that Could be Improved

Sue and Dave are always looking for better ways to help the students examine the process. Adjustments are continually made to find the most effective and helpful times for both the mid-term evaluation and the observations by the teachers.

Advice to Other Teachers

- be careful when selecting project recipients, and make sure that they enjoy working with high school students.
- keep the projects small and manageable, so they are more likely to be completed successfully in the time available.
- think about the potential for press or other coverage as a way for students to see that their project is having a larger impact than just their own involvement.

Expansions

A few potential expansions envisioned include projects in which students produce a larger event for a much wider audience. Running a large event at the school, or a conference of some type would provide this kind of experience. Also, projects focusing more on the social aspects of solid waste management could be emphasized (*e.g.* addressing consumer decisions in broader contexts).

Pathways to Action
Featured Teachers

David Wilkins
Student-run Summer Camp

Related Pathways to Action Projects

- *Simple Classroom Action Projects*
- *Trash-to-Art Festival*
- *Home Recyclables Collection Center*
- *Classroom Worm Bin Project*
- *Cafeteria Composting Project*

Subjects: Biology, Environmental Science
Teacher Grades: 10-12
Project Grades: 10-12
School: Katahdin High School, Sherman Station, ME, serving grades 9-12 with 220 students total.
Teacher Contact Information: Leave a message at school (365-4218).

Summary

A week-long summer science camp for grades K-5 was created by David and the principal of an elementary school in 1990. Originally 'taught' by elementary teachers, high school students have become increasingly involved in all aspects of the program. While the camp has a different theme each year, in 1992 students wrote and received a grant that enabled the development of a recycling/solid waste camp. They attended training programs and planning meetings after school, and implemented the recycling/solid waste camp the next summer. The camp continues to grow and expand, offering many exciting opportunities and challenges for the future.

Goals

There were two main groups associated with this project for which goals were developed. For the younger campers, the goals included 1) making them aware of the waste they create and of the benefits of recycling, 2) stressing that individuals can make a difference, and 3) providing education in a fun way, and encouraging students to implement some changes with their families. For the older high school counselors the goals included empowering the students to plan, design, and implement the program. The personal growth of the students was enormous and a very rewarding result of the work.

The Beginning

David launched this summer science camp program in 1990 with the help of the principal from the elementary school. He had known of similar activities only through gifted and talented programs or colleges, and they were usually quite expensive. They started the program with an environmental theme, focusing on making science fun while creating an open atmosphere for discussion of complex issues. While their goals were educational, they wanted to use many activities and games, and avoid blackboard work, handouts, and note taking. Finally, they wanted to offer the camp free of charge.

Elementary teachers served as the counselors during the first year, and a free 15 week training program was offered for other teachers (one night per week in the spring) to develop skills with hands-on environmental education. This training program attracted elementary, middle, and high school teachers from several districts, and involved active presentations by environmental education organizations, agencies, and others. In addition, participants received formal training in both Project WILD and Project Learning Tree. Working in groups, they focused on preparation, planning lessons, and hands-on environmental education activities. Teachers were grouped with others of similar grades, but they were assigned to groups of kids that were in different grades (this helped make the situation non-threatening for the teachers). The camp met in late July for 5 mornings, and 60 children in grades K-5 enrolled. Some Eisenhower funding was made available and teachers were paid a small stipend.

Changes over the Years

Over the years the range of campers has grown from K-5 to K-8, and the numbers from 60 to 220 by the fourth year. The focus of the program shifted a bit to include math as well as science. Scores from NIEA tests

were used to determine areas needing greater attention. Themes were selected each year for the overall camp, and many topics were addressed within those themes.

While teachers were the counselors in the first year, lack of funding in the second year resulted in a shift of presenters. Many more outside speakers were used and groups rotated to different stations for hands-on presentations. High School students also began helping the few elementary teachers as assistants with microscope activities, etc. A grant was obtained in the third year with students playing a major role (see description below), and Eisenhower funding was obtained for the fourth and fifth years, during which teachers and students shared the counselor roles. Industry sponsors have also helped with financing. Counselor teams have recently been set up in which 4 teachers and 6 high school students work together. With this plan they have been able to keep a counselor:camper ratio of 5:1 at most.

Community receptivity grew, and more parents stayed on for the entire program. Media attention helped spread the word and helped recruit more counselors . As a result David did not have to extend the program beyond one week or beyond the morning session to accommodate the increased demand. Now some of the first campers are coming back as counselors or assistants, and many kids are looking forward to becoming counselors. David talks to them about the responsibilities and commitment they are making, and depending on the funding, they have been paid small stipends.

Many of David's students have opportunities to learn skills through other projects during the school year. Several of his high school students have worked with 2nd graders in a special project focusing on outdoor lab experiences. David also offers other programs in which older students work with younger ones. Often working after school, these students learn how to work with younger students outdoors, and are well suited to become camp counselors.

The Recycling Year

In the third year of this program, two of David's 10th grade students wrote a proposal to Wheelabrator-Sherman, a local facility producing energy from wood chips and other biomass. The focus of this grant was recycling and solid waste, and the students were awarded a grant of $2,500. The students put together a team of 15 10th graders who prepared lessons and worked out the details for the summer program for 140 K-5 students. The grant paid for some guest speakers, supplies, and other costs, but the students did not want to be paid. They volunteered their time in the summer, and presented about 60% of the lessons. Teachers paired with high school student counselors shared responsibility for some groups, but more often than not the high school students handled the groups by themselves. 'Roving' teachers checked on all groups, so help was easily available when needed.

Preparation

For David, the majority of tasks for preparation have included working with student and teacher counselors to make sure planning and training are happening in a timely fashion. He also spends time arranging coverage with the media, arranging for guest speakers, and scheduling field trips.

Coordinator and Counselor Roles

David's role is essentially that of a coordinator and resource person, and he shares some administrative responsibilities with the school principal. As planning teams approach him with guest speaker ideas or needs, he arranges for the guest to speak with all the camper groups. He works with the media, and has been part of regular interviews on radio when camp is in session.

Counselors are expected to teach in a fun and exciting way, and to facilitate the various activities, in addition to everyday preparation and logistics.

The Recycling Year: Sample Activities

- *A guest speaker who talked about how snakes and other animals recycle nutrients*
- *Compost making (an idea that was brought home successfully by many students)*
- *Guest speakers from the Maine Audubon Society and the Soil Conservation Service*
- *Sorting through trash bags (with gloves) to identify which things are recyclable, reusable, returnable, compostable*
- *Making sculptures, artwork, and musical instruments from "garbage" materials*
- *Looking at how other cultures and Native Americans related to nature and the use/reuse of materials from the environment*
- *Field trips to a tree farm, and to the Wheelabrator-Sherman facility*

David Wilkins

Resources and Materials

Many supplies have been available from the school, and others have been bought with outside funding. Some corporations have also been willing to donate supplies or pay some bills for the camp program.

Project WILD, Project WILD Aquatic, Project Learning Tree, Nature Scopes, and the four volume Science and Natural History series produced by the Maine Audubon Society have been valuable resources.

Constraints

The major constraints are budgetary. Eisenhower funds cannot be used for supplies or paying student stipends, which reinforces the need for other outside financial support. Growing interest in the program has caused a few problems, as everyone wants to stay longer. Arranging for backups when guest speakers don't show up has been challenging, and rainy days cause many compromises as well. With the establishment of the Beacon School programs during the summer, additional constraints have been placed on scheduling the camp so that teachers may participate in both. At times, there has been nervousness on the part of some parents about the high school students having such major roles, and the camp has worked to educate the community that the students can handle the responsibilities very effectively.

Support

The superintendent and the school have been very supportive, allowing use of all rooms and facilities, use of some supplies, and providing buses for field trips. The camp is covered by TV annually, and David is interviewed daily on radio when camp is in session. The teachers tend to return, assisting the smooth operation of the camp. In general, the community has been tremendously interested and supportive of the program.

Most Successful Aspects

Campers are learning that science can be fun for everyone, and that they can make a difference. Creative enhancement of the thinking processes has also been provided successfully. In addition, the empowerment, performance, and growth of the high school students has been extremely successful and rewarding.

Aspects that Could be Improved

There has been some inconsistency in the ability of teachers to work with the student counselors. Some teachers have been very supportive and have used students well, while others have tended to give them busywork. David now plans to form teams early and put them to work together planning all aspects for their camper groups to enhance teamwork.

Advice to Other Teachers

To start this type of program, a few elements seem to be crucial, including:

- student members who are very interested in teaching and working with other students
- teachers who love science and are willing to put in time after school, including someone who can serve as a resource person for speakers, field trips, and general program design
- support from the administration
- the use of suitable facilities

New programs should start small, be structured for success, and expand from there, especially if the above elements are hard to find. The more the initial group of teachers and students can take a role in the planning, the more invested they will be, and the more successful the program will be. David has videos of many of the camp activities, which he has made available to other schools looking to start such programs.

Expansions

The present format is strongly favored since energy and enthusiasm for science and math are easily maintained without overwhelming the students. As a one week program, the camp can continue to be offered free of charge.

A camp program for high school students using university faculty has been suggested, as well as expansion to morning and afternoon groups if the numbers of campers continue to increase. A standardized theme for each age group would allow for a predictable progression, and would reduce the duplication of topics or activities that often happens without such a plan.

The program depends on the energy and planning of an individual at present, and a larger committee of teachers, parents, and students has been proposed to provide the program with long term stability. Regular and predictable support by area businesses would also be a great benefit to the program.

David's dream is to have this become a camp run by students for students.

Pathways to Action

Other Waste-Related and Action-Based Programs for Schools

Overview

Pathways to a Sustainable Future *is a new Maine-based program which encourages students and teachers to take action to help solve waste problems in their schools and communities. There are several other programs help raise awareness and promote environmental action in Maine. They have proven very effective. Groups involved with the* Pathways to a Sustainable Future *program are encouraged to find additional ways to educate students and the community, and empower students to make a difference. One or more of these programs may help you with an important next step!*

Waste Away

(Waste management curriculum by Vermont Institute of Natural Science)

Waste Away is an exciting mini-course for grades 4-6, which helps upper elementary and junior high students learn about the solid waste issue, its causes, and solutions. The program uses hands-on activities, experiments, and simulation games. With the help of teachers and parent volunteers, students spread their knowledge to their schoolmates, families, and communities. The objective is to encourage a lifestyle that includes the 3 *R's:* Reduce, Reuse, and Recycle.

The Waste Away program was developed by the Vermont Institute of Natural Science, and has been supported and distributed in Maine by the county Cooperative Extension offices. For a single fee, extension educators work with teachers, students, and four volunteers every two weeks. The volunteers work with students between extension visits. Students then work with other students in the school. The "Trash Festival" culminates the program. Waste Away has served over 80 schools in the first two years reaching over 3000 students and 150 teachers. They in turn have taken the program to the rest of the students and teachers in their schools, to their families, and in most cases to their entire community through the trash festival.

To get involved with the Waste Away program, contact your county Cooperative Extension office (look in the phone book under University of Maine Cooperative Extension for the phone number of your county Extension office.)

Model Community Program

(Maine Waste Management Agency)

The Maine Waste Management Agency has developed two programs that offer businesses and communities the motivation and tools to implement waste reduction strategies. They both emphasize the highest priority on the waste management hierarchy: Reduction. **WasteCap** is a technical assistance program for medium to large businesses. The **Maine Model Business/Community Program** uses education and incentives to minimize waste generation. This program targets businesses, individuals, and community organizations including schools. When an organization meets the pre-established criteria, it is designated a "model" organization, receives an award, and serves as a role model for other organizations.

After taking part in *Pathways to a Sustainable Future*, a classroom or school will have met most of the criteria for the Model Community Program, and may well have gone much further! Use the following checklist to see how you measure up.

Model Community Criteria: School

• = required to receive Model Community designation

∞ = recommended activity

1. Practices waste reduction, reuse, and recycling
   - • use reusable items vs. disposable (e.g. ceramic mugs)
   - • purchase office paper and administrative products made with recycled content
   - • purchase supplies in bulk where possible
   - • set up school recycling program
   - • practice double-sided photocopying
   - • reuse scrap paper
   - • increase use of reusable items in cafeteria (i.e. limit disposables)
   - ∞ reduce amount of junk mail received
   - ∞ request suppliers/manufacturers use as much recycled content material in packaging as possible
   - ∞ request suppliers/manufacturers provide system to take back non-recyclable packaging
   - ∞ purchase and use at least two other items made with recycled content
   - ∞ recycle toner or cartridges for copy machine or printer
   - ∞ minimize use and seek out alternatives to toxics (such as cleansers)
   - ∞ encourage employees to share magazine and newspaper subscriptions

2. Teaches the necessity for waste reduction, composting, and recycling:
   - • conduct internal waste audit to help identify area of greatest need in waste reduction
   - ∞ work with teachers to develop curriculum for students
   - ∞ encourage speakers at assembly programs on topics of waste reduction/recycling
   - ∞ develop program to promote donation of non-recyclable materials such as bottle caps. Styrofoam peanuts, etc. for use in art projects.

Governor's Waste Reduction Award Program

(Maine Waste Management Agency)

The Governor's Waste Reduction Award is a public service awards program for the public and private sector. It recognizes outstanding efforts to promote solid waste reduction by organizations in Maine. Schools are in the public sector category for municipalities.

To nominate your project, simply get an application form from:

Maine Waste Management Agency
State House Station 154
Augusta, Maine 04333-0154
(207) 287-5300 or (800) 662-4545

Entries are judged by the following criteria:

- Adopts a resolution which incorporates the organization's environmental ethic, demonstrates commitment to reduce, reuse, recycle, and commits to buying products with recycled content.
- Conducts an analysis of the organization's waste stream.
- Reduces the waste stream through Reduction, Reuse, and Recycling efforts with emphasis on minimizing waste at the source.
- Raises public awareness and increases participation in waste reduction programs.
- Demonstrates outstanding efforts to procure products with high post consumer recycled content.

Submit the application with a description of the project by the deadline (usually October 1 each year.) Explain what was done, how it was accomplished, and describe the results of the waste minimization efforts.

Other programs

CoastWeek - Coastal clean-up effort

(Maine Coastal Program)

The CoastWeek clean-up is part of a national coastal clean-up effort. In early October (the dates vary from year-to-year) groups of adults and children volunteer to patrol sections of coastal shoreline to pick up litter and all kinds of trash. The varieties of materials are cataloged and weighed and the data is submitted to regional coordinators who compile and send it to the state CoastWeek Coordinator. The information is compiled nationally and documents the types and volume of materials recovered. This census of coastal trash can be extrapolated to determine how much trash there actually is in various parts of the open ocean. The data is also used to identify the most serious sources of ocean trash and steps can be taken to reduce its production at the source.

To get involved with the CoastWeek effort contact:

CoastWeek Clean-up Coordinator
Maine Coastal Program
State House Station 38
Augusta, ME 04333
(207) 287-3261

The state coordinator will put you in touch with your local area coordinator who can assign your group a section of shoreline and will give you the necessary instructions and forms.

Kids' EcoTeam Program

(Global Action Plan of Maine)

The EcoTeam program is a national effort to help people transform their desire to make a difference into effective action, and to show how personal and family actions can have an impact. EcoTeam is a project of the national Global Action Plan for the Earth and its Maine affiliate, Global Action Plan of Maine. It is the first integrated program for household environmental action. The program carries people beyond simple lists to an organized program of action that can help people achieve real results. It is an effective tool to dramatically change an unnecessarily wasteful household into an environmentally sensible one.

The EcoTeam process divides the overwhelming task of improving the environment into six specific action areas which feel more manageable and relevant on a personal level. An EcoTeam can be any small group of friends, family members, neighbors, or work colleagues who develop a support team to work on one action area per month for six months.

EcoTeams work to:

- Reduce Your Garbage
- Improve Home Water Efficiency
- Improve Home Energy Efficiency
- Improve Transportation Efficiency
- Be an Eco-Wise Consumer
- Empower Others through Household, Workplace, and Community Action

The Kids' EcoTeam is a 26-week program where a class or group forms EcoTeams of 6-7 students each, and spend six weeks in each action area. Team members support each other to learn together, take action, and realize practical results. Children and households form a partnership in which they assess their homes and determine the actions they will need to take to bring them into environmental balance.

Global Action Plan for the Earth provides a Teacher's Guide to the Kids' EcoTeam Program, a one-day training session, and additional resource materials. The program is designed for grades 5-8, but modifications can be made for younger children.

To get involved in a Kids' EcoTeam Program contact:

Maine Audubon Society
118 US Rte. 1
Falmouth, Maine 04105
(207) 781-2330

KIDS (Kids Involved Doing Service)

The KIDS Consortium is dedicated to improving children's lives by providing them with opportunities to learn the skills and attitudes essential to building a reasonable, viable future. KIDS develops, implements, promotes, and researches experiential programs through which children learn that they matter.

KIDS has several model programs in Maine, all involve students and their teachers engaging in real-life issues or problems in the community. Some involve the environment, and others focus on social or political issues. All the activities help students gain a sense of empowerment and self-esteem.

To investigate opportunities with KIDS contact:

KIDS Consortium
State House Station 130
Augusta, ME 04333

David O. Willauer, Project Coordinator
(207) 624-6800
Marvin Rosenblum, Executive Director
(207) 633-3152

The Critical Skills Program

Training Institutes for Teachers
Antioch New England Graduate School

The Critical Skills Classroom™ is a comprehensive and dynamic model that arose from the belief that education must be experiential— that it must nurture interdependence and must enable all members of each generation to develop the judgment necessary to take responsibility for the conduct of their lives, for the shaping of their society and for the survival of the planet. Since 1982, the Critical Skills Program has been offering training for experienced educators in the Critical Skills Classroom™ model through its summer institutes. This model is driven by eight desired outcomes. These outcomes were derived from a decade of classroom-based research. They have great resonance with the recent school restructuring efforts of many communities.

The goal of education in a Critical Skills Classroom™ is the development of individuals who consistently demonstrate that they:

- have a meaningful base of essential knowledge
- possess skills that are critical to the needs of the times
- are responsible and invested owners of life-long learning
- are reflectively self-directed with a strong work ethic
- have a well-developed internal model of quality work
- are trustworthy, have integrity and are of ethical character
- seek to optimize work through collaboration
- are responsible and active members of communities

These goals become part of the culture of each classroom and are consciously woven into student challenges. They guide the routine formation of standards for quality work and create the framework for assessment.

Other programs

The centerpiece of the Critical Skills model has been the real-life problem. This is a real problem in need of a solution. It has the potential for actual implementation at the class, school, community, regional, national, or global levels. It involves students deeply, directly and immediately in active inquiry. Through this "Learning by Real Problems" approach, they move outside the classroom, take action on issues, and have a tangible impact in their communities. Specific skills are emphasized throughout the process, including problem solving, decision making, communication, collaboration, leadership, documentation, and many others.

Training programs in this model are offered through Critical Skills summer institutes. These institutes are highly experiential, immersing the participants in the model. They are designed to help participants to:

1) develop a sound understanding of the Critical Skills model,
2) redefine goals, attitudes, techniques, and roles of teaching and learning, and
3) create practical strategies for implementation.

Participants engage fully in each of these challenges, and exhibit their products and solutions. They reflect on their learning and transfer that learning through attention to its future application in their own classrooms. At the same time, they explore the teaching cycle which guides student experiences, leaving the institute with practical knowledge of how to build and maintain a learning community. They actively craft problem-based challenges. They examine the role inherent in classroom coaching and use and develop assessment tools. They have the opportunity to reflect on and to discuss their own attitudes, ideas and issues— to explore their readiness for change. During the following year, skilled practitioners from the Program visit participants in their classrooms and coordinate follow-up meetings and workshops designed to provide individualized attention to the issues and needs of each participant.

Institutes are offered on-site for 16-18 members of individual school districts, or for several districts cooperating toward a regional institute. It may also be possible to send a team to an institute being offered in your area. Each summer, 10-15 Critical Skills Institutes take place in Maine. For further information, contact:

Critical Skills Program
Antioch New England Graduate School
40 Avon Street
Keene, NH 03431
(603) 357-3122.

Background Information and Resources

Background Information

Overview 198

Source Reduction 202
1 in the Waste Management Hierarchy

Reuse 205
2 in the Waste Management Hierarchy

Recycling 207
3 in the Waste Management Hierarchy

Composting 213
4 in the Waste Management Hierarchy

Waste-to-Energy, Incineration 217
5 in the Waste Management Hierarchy

Landfilling 221
6 in the Waste Management Hierarchy

Household Hazardous Waste 224

Resources

Instructional Resources 229

Trade Books for Younger Students 233

Organizations and Agencies 234

***California* Compendium for Integrated Waste Management** 239
Reviews of outstanding curriculum materials summarized from the *Compendium*

Glossary 249

Background Information

Overview

Introduction

What is *waste*? For humans, waste refers to all materials for which people no longer have any use. For example, when we unwrap a candy bar, the wrapper has finished serving its purpose and becomes waste. When a farmer harvests his cornfields, the bare stalks become waste. When a minerals company mines iron ore, the earth that they must remove becomes waste. When a television set starts to broadcast snow instead of the evening news, it too becomes waste.

Waste is a natural by-product of use. Virtually all activity in the world creates waste of some kind. Even as oak leaves store energy through photosynthesis, they produce oxygen and water as biological waste. When squirrels eat seeds from pine cones, they leave behind pieces of the cones in piles of waste. When all living organisms die, their bodies become waste.

In the natural world, however, waste from one process is inevitably useful for some other process. The waste oxygen from plant photosynthesis, for example, is essential to all animals in the process of respiration. Conversely, the waste carbon dioxide from animal respiration is used in photosynthesis. Animal excrement returns valuable nutrients to the soil. The bodies of dead organisms are nourishment for other organisms. From this perspective, it is easy to see that waste is a valuable resource if it is managed properly!

Humans could learn a good lesson from nature about waste. The waste humans generate — called *solid waste* — is a necessary and natural part of human life. However, we must find ways to manage our waste effectively to reclaim the valuable resources in the things that we no longer need! Unfortunately, this is not always easy to do. Many of the materials in the solid waste stream, especially man-made materials such as plastics and chemicals, can be difficult to use more than once. Unlike in balanced natural ecosystems, these wastes that cannot be reused in any way pile up or become hazards to the surrounding environment. Therefore, it is critical that we pay close attention to the waste that we generate and that *we do not create more waste than our environment can handle!*

Where We Are Now

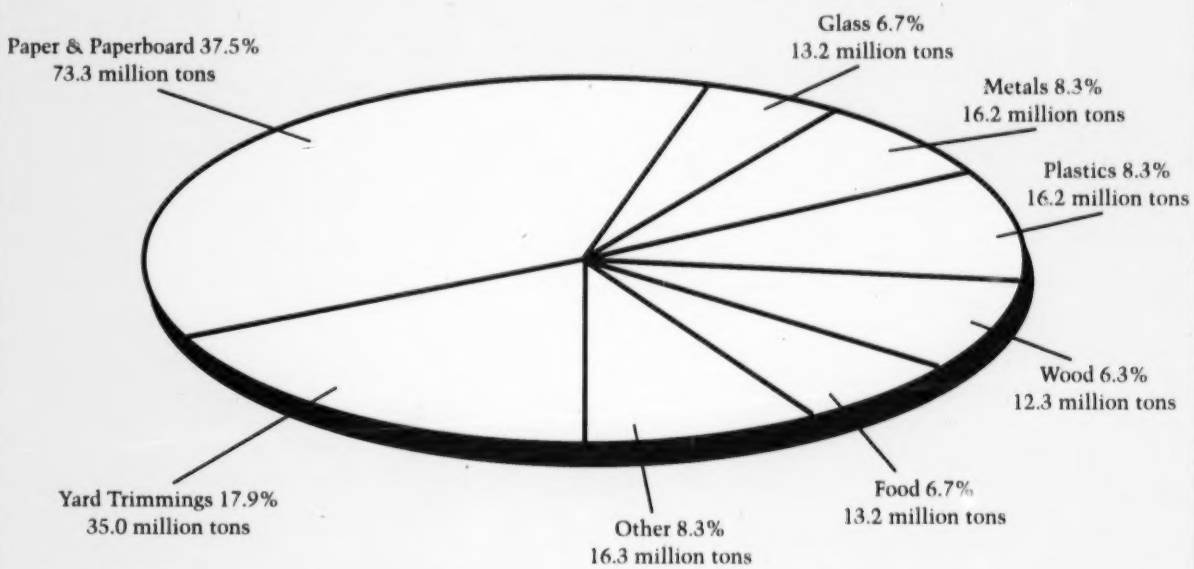
The United States creates roughly 11 billion tons of solid waste every year. This includes 6 billion tons of agricultural waste, mostly in the form of crop residues and waste water; 4 billion tons of mining waste, mostly in the form of mine tailings and removed earth; and 800 million tons of industrial waste, including chemicals and waste water. (Certain types of waste water are considered solid waste.) The remaining 200 million tons (approximately) of the solid waste generated is classified as *municipal solid waste*.

Municipal solid waste (MSW) is waste that is generated by households, businesses, and state and federal governments. It is trash that people generate every day in the course of their daily routines at home and at work. It is collected in dumpsters, curbside trash cans, compost bins, and at redemption centers to be disposed of. It includes discarded packaging, food wastes, broken toys and appliances, yard wastes, waste paper, and much more.

The following graph shows the composition of MSW in the United States. Although the waste stream varies slightly around the country, the graph represents the country as a whole.

Materials generated in Municipal Solid Waste by weight, 1990

(Total weight = 195.7 million tons)



(From EPA 1992 Update, Executive Summary)

Why worry about municipal solid waste? It is true that municipal solid waste represents only 2% of the waste generated in this country. What about the 98% of all waste that is generated in agriculture, mining, and industry? This waste is certainly important to consider. It needs to be managed effectively, as does all waste. But farmers, mining companies, and industrial manufacturers manage their own waste (and pay for it) as a normal part of doing business. They use *private* facilities to compost, landfill, and incinerate virtually all the waste they generate.

The burden of managing municipal solid waste (and paying for it), however, is shared by everyone in this country, as we all share in producing it. Whereas private companies decide on their own how to manage waste, we must decide collectively, through local and state governments, how to manage municipal solid waste. It is important that, as educated citizens, we are all aware of the issues surrounding municipal solid waste disposal so that we can make good decisions about it.

Secondly, municipal solid waste generation has been increasing steadily at a rate of 3-4% annually for the last thirty years. Facilities for handling solid waste cannot accept many more materials than they already do. Therefore, municipal solid waste management is a growing problem today that needs to be addressed.

Waste Management Methods

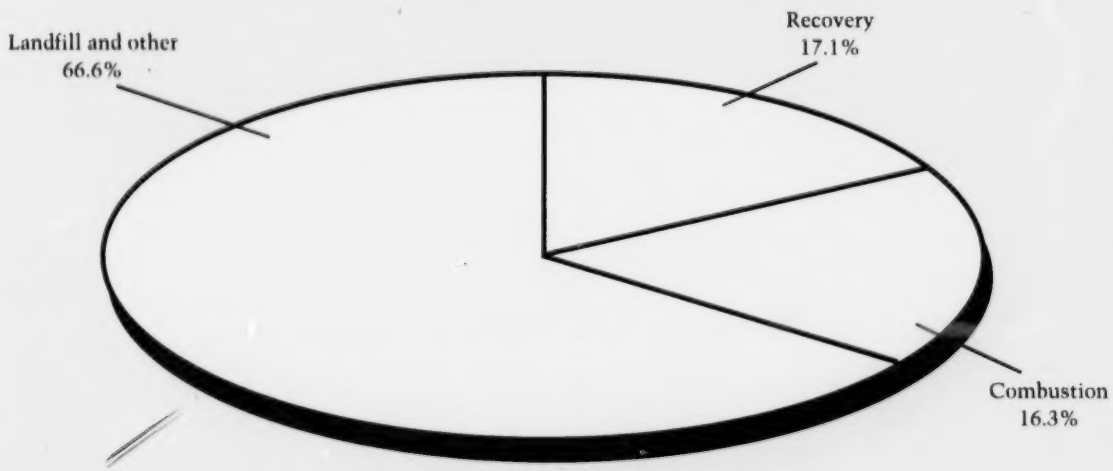
There are six major methods of managing solid waste. The United States Environmental Protection Agency (EPA) has ranked these methods in a hierarchy from most preferable to least preferable. This hierarchy has been adopted by the Maine Waste Management Agency (MWMA). The hierarchy is as follows:

1. *Source reduction* - the reduction of the amount and toxicity of waste in the manufacture, packaging, and use of products;
2. *Reuse* - the use of durable products instead of disposable ones;
3. *Recycling* - the manufacture of new products from waste materials;
4. *Composting* - the biological decomposition of organic waste;
5. *Incineration* - the burning of waste, usually with energy recovery capability;
6. *Landfilling* - the burial of waste in secure facilities.

There are a number of other methods of processing waste that are high tech adaptations of composting or incineration. They are practiced on a small or experimental scale in this country and have not been addressed directly by the EPA. They include: *vitrification* of waste, a process in which waste is exposed to extremely high temperatures and thereby transformed into dense, inert chunks of material; *natural gas generation*, in which gas is collected from the decomposition of certain wastes and later burned; and *high-speed digestion*, in which the natural composting process is speeded up to reduce organic wastes.

The graph below illustrates how the U.S. municipal solid waste stream was actually managed in 1990. It is revealing that landfilling and incineration, the two lowest priorities in the EPA hierarchy, are the methods of waste disposal that are most common in the United States. In spite of the high priority of source reduction, the overall size of the national waste stream continues to grow each year.

Management of Municipal Solid Waste in the U.S., 1990



(From EPA Characterization of Municipal Solid Waste in U.S., 1992 update)

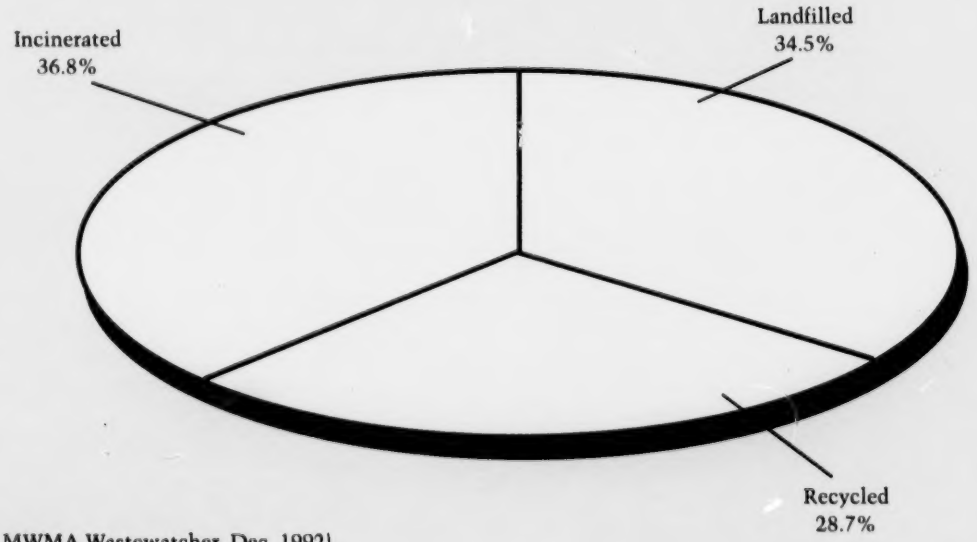
The State of Maine differs with regard to solid waste management. The statewide bottle deposit law and the operation of four large incinerators in the state help explain why landfilling accounts for less than half of the state's waste. The Maine Waste Management Agency also has a variety of aggressive recycling and waste management programs, including the Model Business and WasteCap programs which assist companies and communities in reduction and recycling efforts. The Agency also offers assistance for specific solid waste management projects.

The number one priority in the EPA hierarchy is source reduction, which calls for a reduction in the amount and toxicity of solid waste that we create in this country. In short, as we assess how to manage our waste, *where waste comes from* is even more important to consider than where it goes! Source reduction is a call to examine our *consumption* first of all when we examine waste management!

When we consider that the United States has one of the highest rates of consumption of any country in the world, it is no surprise that we also have one of the highest rates of waste generation of any nation in the world. It follows that one of the ways that we will achieve significant reduction of the waste stream will be to change our current patterns of consumption. This may require us to give up some of the convenience that we have come to expect, such as lunch platters packaged in disposable plastic packaging. It may have short term financial costs, such as the construction of recycling plants and investment in refillable bottle systems. But making wise decisions about what we buy and how we use the items that we already have is a small sacrifice to make in order to reduce our waste stream. And ultimately, in the long run, reducing our waste stream will return financial benefits as well as environmental ones.

Each method of solid waste management in the EPA hierarchy is featured in a background information section that follows.

Municipal Solid Waste Management in Maine, 1991



(From MWMA Wastewatcher, Dec. 1992)

Background Information

1 Source Reduction

Introduction

The most efficient, inexpensive, and environmentally sound method of managing municipal solid waste is simply to avoid producing it in the first place. Waste that is never created does not need to be collected, requires no transportation, takes up no landfill space, creates no pollution, and costs nothing to handle. Although this statement seems absurdly obvious, apparently it is not to most Americans. For all the talk about the growing problems of waste management in the United States, we keep on producing more garbage in this country every year!

Source reduction, the attempt to decrease the amount *and the toxicity* of solid waste produced, is the highest waste management priority identified by the U.S. EPA and the Maine Waste Management Agency. That means as a nation and a state, we should be looking for ways to reduce the amount of waste we generate *before* we concentrate on incineration technologies and recycling programs. No method of waste management will lead to a sustainable future if we continue to produce more and more trash every year.

The biggest target for source reduction efforts is packaging which comprises 33% (by weight) of Municipal Solid Waste (MSW.) A significant reduction in packaging use would have an immediate impact on the solid waste stream.

Where We Are Now

The United States municipal solid waste stream has been growing at a rate of between 3% and 4% each year since the 1960s. Our country produced 88 million tons of solid waste in 1960 (2.7 pounds per person per day) and 195.7 million tons in 1990 (4.3 pounds per person per day). At this point, specific source reduction efforts should be focused on stopping this growth of U.S. waste production.

The state of Maine has a somewhat more enviable record on source reduction. The size of Maine's municipal solid waste stream has actually decreased in recent years; the total amount of waste generated in 1991 was 9.5% *less* than the total amount generated in 1988. However, this trend may be hard to maintain. One of the reasons given by Maine Waste Management Agency officials for the 1991 figure is that an economic recession helped to slow overall consumption in the state and, consequently, the rate of waste generation. Unfortunately, up to now healthy economies have stimulated higher levels of waste production. Our source reduction efforts must be equal to the challenge in the future.

Source Reduction Strategies

Packaging manufacturers and consumer goods companies can follow several different paths towards the goal of source reduction. Efficient materials use is a simple path. For example, the use of light-weight materials in manufacturing, a process known as *lightweighting*, yields products that are relatively inexpensive to produce, that function well, and that create less waste. Aluminum cans are manufactured today with 30% less aluminum in each can than just 20 years ago, with little or no loss of strength. Some products, particularly laundry detergents, can be concentrated. The packaging needed for concentrated products can be significantly less than that necessary for unconcentrated products.

Even better, companies can eliminate some packaging altogether. Certain items, such as hardware goods, books, and grocery produce do not need individual packaging at all. Other items, particularly dry food items, can be sold in bulk quantities.

Consumer goods can also be made more durable than they currently are, designed for multiple use and built to last. These kinds of products will stay out of the waste stream longer than cheap alternatives. Many products can be manufactured without the use of toxic ingredients such as heavy metals and corrosive chemicals. The manufacture of batteries with significantly less mercury (a toxic heavy metal) content, is a good example.

As consumers, we can choose what products we purchase. Our choices will dictate, to

a large extent, what kinds of products companies put on the shelves. If we do not purchase overpackaged items and cheaply built goods, companies will stop producing them. More importantly we need to ask ourselves before every purchase whether the item we are considering buying is necessary in the first place!

Plastic Packaging: A Source Reduction Case Study

Plastic is one of the fastest-growing sectors of the municipal solid waste stream, and is often singled out as a good target for source reduction efforts. Overall, plastics make up 8.3% of the total waste stream in the United States by weight (16.2 million tons), and 21% by volume.

The benefits we would derive from reducing the amount of plastic used in this country are substantial, beginning with the manufacturing process of plastic itself. First, plastic is made from petroleum, a nonrenewable resource, most of which must be imported from other countries. It also requires the use of five of the EPA's six most hazardous chemicals in its manufacturing process. Plastic production, in fact, is the major industrial use of four of these six chemicals. Consequently, between production and processing, plastic manufacturing creates up to ten tons of hazardous waste for every ton of plastic! Plastics production also has air pollution costs. Any reduction in demand for plastic products would be a reduction in demand for foreign petroleum and these toxic chemicals.

Reducing our use of plastic would also reduce the amount of plastic that ends up in landfills and incinerators. Since plastics are lightweight, they consume lots of landfill space for their weight. Since they do not decompose, once they are buried in a landfill they do not compact any further. Although plastics have a good fuel value for waste-to-energy incinerators, certain plastics (such as polyvinyl chloride) produce strong toxic acids and highly corrosive chemicals when burned. And both incinerators and modern landfills charge at least $40 per ton to dispose of plastics, as for all other waste.

Reducing plastic use and production in this country offers many benefits in terms of cost savings, minimizing a variety of environmental impacts, and decreasing reliance on foreign petroleum resources. Source reduction means that we do not need to find alternatives to this plastics use -- we simply stop producing as many plastic products as we currently do. Although plastic products are particularly good candidates for source reduction, all source reduction efforts are directly beneficial for our waste stream and our pocketbooks.

Encouraging Source Reduction

Federal and state governments may provide needed incentive for widespread source reduction efforts. The U.S. EPA, in publishing its waste management hierarchy, has declared source reduction to be its first priority in solid waste management, even ahead of recycling or composting.

The state of Maine has gone even further. Recent laws have restricted or banned certain types of batteries that contain heavy metals and restricted the use of many toxic inks in packaging. The Governor's office has called on all state agencies to practice source reduction. Furthermore, the Maine Waste Management Agency has set a goal for the state as a whole to reduce the municipal solid waste stream by 10% below 1988 levels by 1994 (and by an additional 10% over time). The Agency helps businesses, communities, and individuals to work towards this goal by offering grants, technical assistance, information, and incentives through a variety of programs.

Besides state government intervention, the implementation of *user fees* in municipalities can be a powerful encouragement for families to reduce the amount of trash they produce. A user fee is a price that is charged for garbage pickup, usually linked to the amount of garbage to be disposed. The more waste a household produces, the more they have to pay for removal. This economic pressure tends to encourage households to reduce waste substantially.

1 Source Reduction

Conclusion

Convenience is alluring, whether it is in the form of individually wrapped cheese slices or disposable razors. Plastic and paper for packaging are inexpensive. The patterns of consumption that we have become used to in this country are hard to break. So we continue to produce more garbage every year, even as we grumble about constructing new landfills and incinerators.

The logic behind source reduction is simple: the less we use, the less we will need to throw away; the less toxic a waste product is, the less it will harm the environment. We would be well served by looking at where our waste comes from as well as where it ends up! This means we must try to stop the growth of the waste stream and eventually turn our attention to shrinking it. To be optimistic, there has never been more room for improvement! And we all have a role to play in the effort: Ultimately, source reduction really does start with the consumer who refuses to buy wasteful products.

BIBLIOGRAPHY

Books and Pamphlets

1. *War on Waste*, by Louis Blumberg and Robert Gottleib, Island Press, Washington, D.C., 1989.

2. *Characterization of Municipal Solid Waste in the United States: 1992 Update, Executive Summary*, U.S. EPA, July 1992.

3. *State of Maine Waste Management and Recycling Plan*, by Maine Waste Management Agency, April 1993.

Other Resources

1. "Integrated Waste Management Priorities in Maine," Maine Waste Management Agency Fact Sheet, January 1993.

2. "What is Pollution Prevention?" Chemicals in the Environment Information Center, University of Maine, Orono, 1992.

3. "Waste Reduction Options for Businesses and Industry," Maine Waste Management Agency Fact Sheet, January 1993.

4. "Maine Model Business/Community," Maine Waste Management Agency Fact Sheet, July 1993.

5. "Waste Reduction Tips For Consumers," Maine Waste Management Agency Fact Sheet, April 1993.

6. "The Waste Watcher", Maine Waste Management Agency Newsletter, June 1992. Issues produced quarterly.

❷ Reuse

Introduction

In the last fifty years, there has been a growing trend in the United States to manufacture and consume single-use, disposable products. Disposable diapers, plastic milk and soda bottles, and ball point pens are examples of products that have almost completely replaced reusable alternatives in recent decades. While disposable products are often quite convenient, they waste natural resources and consume a large percentage of current landfill space.

Reusing products, either for the purpose that they were designed or for another purpose is a method of waste management. We benefit from reuse in many ways. Consider what happens when we drink from a glass, wash the glass, and put it back into the cupboard. First, we do not need to buy a paper cup which will end up in a landfill. Secondly, we do not need to use any paper, energy, or water to make the paper cup. Thirdly, we postpone the time when the glass itself will go into a landfill. And it is usually less expensive to wash the glass than it is to buy paper cups anyway!

Where We Are Now

It is very hard to estimate how much of the municipal solid waste stream (MSW) gets reused, because items that are being reused do not get put into the waste stream at all! For example, refillable bottles are collected by beverage distributors directly and are never put into household trash; if a person washes a yogurt container and uses it for holding nails, it does not get thrown into the trash to be counted as solid waste for quite some time.

Reuse is not as common as it once was. Virtually all milk sold in the United States today comes in single-use plastic-coated paper cartons or plastic jugs. Fifty years ago the majority of milk was sold in refillable glass bottles and delivered to people's doorstep. Disposable plastic-and-paper diapers now account for 90% of all diapers used in this country, although we have used them widely in only the last thirty years.

Reuse Strategies

Reuse goes beyond merely using products more than once. Consumers can choose to purchase products that are durable and designed for multiple use rather than those that are disposable. For example, cloth napkins can be purchased once and washed regularly in the place of hundreds of paper napkins. Consumers can also choose to repair broken items instead of discarding them and purchasing replacements. This takes true commitment since it may be as expensive or more expensive to repair a broken appliance as it is to buy a new one. Finally, individuals can be creative about the waste they would normally discard to find alternate uses for many materials. Old newspapers can be used as packing material; plastic milk cartons can be made into bird feeders and bird houses; the reverse side of white paper can be used as a scratch pad.

For reuse strategies to make a significant impact on the amount of waste we generate, however, packaging manufacturers must join consumers in the endeavor. In the U.S. there are few economic incentives to provide reusable or returnable packaging. Lightweight plastic and aluminum packaging can be very inexpensive in the short term, yet it adds significantly to the waste stream. As further work is done to analyze product and packaging life cycles, we will better be able to determine the true cost (including the environmental cost) of different materials.

Energy Savings and More

Reusable packaging may offer the most efficient way to package goods. Two consumer goods studies completed in the last fifteen years found that refillable glass bottles provided the most energy efficient method of delivering beverages to stores, requiring 1/10th the energy in manufacturing as plastic bottles made from virgin plastic and 1/5th the energy as recycled aluminum cans. (These studies assumed that the glass bottles could be reused eight to ten times, and in practice, reusable bottles can often be used up to 50 times!) Initially, reusable packaging such as refillable bottles cost as much to produce as other containers, but

subsequent uses of the packaging require only the energy to wash the bottles, not the energy to melt aluminum or mold plastic. The washing process required with reusable packaging also creates less air, water, and solid pollution than the production of new containers.

Reusable products save consumers lots of money on waste disposal. Landfilling the 18 billion disposable diapers used in this country every year costs between 100 and 300 million dollars in the form of landfill and incinerator *tipping fees*! Indirectly, this money comes from consumers through taxes or waste disposal fees. Reusable cloth diapers, on the other hand, can be reused hundreds of times before they require disposal and thereby offer considerable savings in the area of disposal costs alone.

Conclusion

Reusing products is a simple way to decrease the amount of waste that we need to throw away. We can help ourselves by purchasing products that will last a long time, by repairing broken appliances, and by finding new uses for old products.

As a society, we can encourage companies to manufacture reusable packaging and durable products.

BIBLIOGRAPHY

1. "Recycling Plastics," by Hannah Holmes, *Garbage* Magazine, Jan./Feb. 1991, pp. 32-39.

2. "Cloth vs. Disposable Diapers," Fact Sheet from the Maine Waste Management Agency, April 1990.

3. "Discarding the Throwaway Society," Worldwatch Paper 101, by John E. Young, Worldwatch Institute, January 1991.

3 Recycling

Introduction

In its literal sense, the word *recycle* means to turn over again. Recycling is one of the most publicized methods of waste management in Maine and the United States, and is the process of turning old products into new ones. However, recycling is distinguished from reusing in that it entails some reprocessing of materials. For example, aluminum cans are recycled when they are melted down and remolded into new cans; glass deposit bottles are reused when they are washed and refilled.

Recycling is a valuable method of handling certain solid wastes, for the simple reason that it diverts materials from landfills and incinerators. Its greatest value may be as an alternative to the manufacture of all products from raw materials. This is economically sensible and it conserves natural resources! Many materials can be recycled, including aluminum, steel, tin, and other metals; glass; a wide variety of paper products; many types of plastic; and miscellaneous other materials such as waste oil, paint, and textiles. These materials that can be recycled are called recyclable materials. It is important to distinguish between these "recyclables" and actual recycled products, which are made out of reprocessed materials.

Recycling is not as simple as landfilling or incineration, however! It requires a strong commitment from *everyone* if it is to be successful. Companies must manufacture products with recyclable and recycled materials; towns and individuals must collect recyclable wastes; the government must support recycling on all levels; and perhaps most importantly, people must create the demand for recycling and "close the loop" by buying recycled products!

Where We Are Now

In 1990, 17.1% of all wastes generated in the United States (by weight) were recycled, led by aluminum which achieved a recycling rate of 38.1%. (A "recycling rate" refers to the percentage of a given material that is culled out of the waste stream and reprocessed into a new product.) This 17% recycling rate represents a slight improvement over previous years, but a much higher rate can be achieved. An experimental recycling program in an East Hampton, New York neighborhood achieved an overall recycling rate of 84%!

Maine has one of the highest recycling rates of any state in the country. In 1991, Maine residents recycled 28.7% of all municipal solid waste. (This includes a composting rate of 0.7%; therefore, recycling excluding composting totaled 28.0%.) This high rate is due in part to Maine's bottle bill, state laws that require recycling of office paper, and corrugated cardboard, and aggressive recycling goals set in the Maine Solid Waste Management Plan. Ultimately, Maine residents are willing to participate in recycling programs. Nearly all Maine communities now have recycling programs of some kind.

We can still do better! The Maine Legislature set a goal for Maine residents to recycle 50% of the solid waste stream by January 1, 1994!

Recycling Rates for Selected Materials

	U.S. 1990	***Maine 1991***
Paper and Paperboard	28.6%	32%
Glass	19.9%	70%
Metals	23.0%	81%
Aluminum	*38.1%*	*68%*
Steel/Ferrous metals	*15.4%*	*83%*
Plastics	2.2%	15%
Textiles	4.3%	34%
Overall Recycling Rate, All Materials	***17.1%***	***29%***

Background Information

3 Recycling

Collection of Recyclables

The first step in any recycling program is the collection of used materials. There are many ways that this happens, but success usually requires consumer cooperation. Some towns have voluntary collection programs in which residents can choose to bring in recyclable goods such as plastic milk jugs and steel food cans to a town recycling center. Some towns have *curbside pickup* programs in which a collector picks up separated recyclable materials, just like household trash collection. Maine and other states have laws, often called bottle deposit legislation, or *bottle bills*, which give individuals a small cash rebate (5-15 cents per container in Maine) for returning beverage containers to redemption centers. All of the bottles and cans that are collected through this law are recycled in Maine, a total of 94% of all bottles and cans covered by the law.

Even if consumers do not separate materials out of the waste stream for recycling, sometimes valuable materials are saved for recycling before they are landfilled or incinerated. At refuse-derived fuel incinerators (Maine has three), metals, glass, and some other materials are culled out of the waste stream before incineration to be recycled.

Finally, manufacturers often recycle their own waste. Paper companies, for example, recycle the wood scraps and paper pulp that are left over after the paper manufacturing process; metal manufacturers recycle scrap steel from the forging process. This saves them money and materials.

Average Prices of Recyclable Materials Paid by Brokers to Municipalities in Maine, 1994

Material	*Avg. sale price, per ton*
Aluminum cans	$600
Plastics, PET (Soft drink containers)	100
Plastics, HDPE (Milk jugs)	236
Paper, high grade office	90
Newspaper	61
Old Corrugated Cardboard	131
Glass, clear	26
Tin cans	57

Markets for Recyclables

Recyclable materials, once they are collected, often become a valuable commodity. Town recycling centers can sell some of these bulk materials to brokers — and the town can avoid landfill tipping fees at the same time! (See chart below.) The brokers may be willing to pay for many materials because they can in turn sell the recyclable materials to manufacturers. And the manufacturers are willing to buy the bulk recyclable materials because they can substitute recyclables for raw materials at a competitive cost. As long as consumers are willing to purchase products with recycled materials, markets for recyclable materials will continue to improve.

PAPER

Waste paper comes to recycled paper mills in large bales. Some mills accept only certain kinds of waste paper — such as newsprint, high grade office paper, or cardboard — but the recycling process for all of these papers is similar. The waste paper is shredded and added to water in a large blender called a *hydrapulper*. Spinning blades in the hydrapulper beat the paper until the individual paper fibers separate which usually takes about 15-20 minutes. The resulting mixture, or *slurry*, is about 2% fibers and 98% water, and it can be used alone or combined with new pulp to make new paper. Depending on what kind of new paper will be made, the slurry may need to be de-inked. However, nearly 50% of all U.S. recycled pulp is used in new paper products that do not need de-inked fibers, such as grocery bags, cardboard, and paperboard.

Recycling paper is not entirely efficient, however. Some of the fibers in recycled pulp become too short in the process to be used in making new paper. These short fibers, approximately 10% (by weight) of the waste

paper, are removed from the pulp and must be burned, composted, or landfilled.

Furthermore, waste papers are often recycled into "lower use" products. Waste newspaper does not always get recycled into newsprint; often it gets recycled into paperboard or tissue paper. Consider that nearly two-thirds (63.9%) of all high-grade office paper recovered from the municipal solid waste stream is recycled into "lower use" products such as tissue paper, paperboard, or containerboard, which usually cannot be recycled themselves. In this sense, much of our paper recycling efforts postpone some form of eventual disposal.

Consumers should also be aware that recycled papers are not always made from used waste paper, such as old newspapers or office paper. "Recycled papers" can also be made out of wood scraps and other paper mill wastes. The percentage of the pulp used in making new recycled paper that comes from paper used and then collected for recycling is called its *post-consumer* recycled content. The percentage that comes from waste materials collected in the mill and diverted from the waste stream is called *pre-consumer* recycled content. While the use of both kinds of recycled content in paper manufacturing helps reduce the demand for unused pulp, the purchase of papers with a high post-consumer recycled content (the higher the better) helps to stimulate the markets for recycling paper products.

Paper is the recycled product most commonly manufactured in the state of Maine. Most other recyclable materials that are collected in Maine are shipped to recycling companies in other states. By 1995, two new paper recycling plants in the state will more than double the state's paper recycling capacity from 1991 levels. Maine will need to import waste paper from other states to keep these plants operating at full capacity.

ALUMINUM

Aluminum is one of the easiest and most efficient materials to recycle. When scrap aluminum comes to recycling plants, it is put into furnaces and heated into molten aluminum. During the heating process, impurities, including paints, are burned off. (Aluminum beverage can recycling often includes a step that removes the paint from cans before they are put into the furnace.) This purified molten aluminum is then alloyed, if necessary, poured into molds, and formed into ingots. The ingots are later shaped into new aluminum products. This process is much simpler and cheaper than producing pure aluminum from bauxite ore. It takes less than 1/20th of the energy to produce recycled aluminum as it takes to produce unused aluminum! The manufacture of recycled aluminum also generates less air, water, and solid pollution than the original manufacture of aluminum.

In 1990, 38.1% of all aluminum in municipal solid waste in this country was recycled, including 62.4% of all aluminum beverage cans. Maine residents recycled 47% of aluminum in the waste stream, including over 90% of all aluminum cans; all of these are shipped out of the state for recycling.

STEEL

Steel is recycled through a process very similar to the aluminum recycling process. Scrap steel and steel cans ("tin" food cans are actually steel cans with thin coating of tin) are sorted according to their alloy, melted down in high temperature furnaces, purified, and reformed into ingots. These ingots are later remelted and poured into molds for shaping into new steel products. This saves over half the energy of initially manufacturing steel and contributes significantly less air and water pollution.

Although the official U.S. recycling rate for steel in municipal solid waste is relatively low (15.4%), recycled steel accounts for a large percentage of all steel produced in this country. Virtually all steel produced today has some recycled content, and according to the Steel Recycling Institute, 40% of all steel produced in the U.S. has 100% recycled content. If the steel recycling rate is so low, where does all the used steel come from? It comes from old buildings that are torn down, old automobiles, and other sources that do

not ever figure into calculations of steel recycling from municipal solid waste. The Steel Recycling Institute claims that the amount of steel collected for recycling each year from all sources equals two-thirds of the amount of total steel produced in the U.S.

GLASS

Aside from the fact that glass has three different colors, it is easy to recycle. Clear glass is the most valuable since it can be remanufactured into any color, while green or brown glass can only be made back into a dark color. First, used glass is crushed into small pieces, called *cullet*, and screened for foreign objects such as bottle caps and small stones. The cullet is then melted in a furnace to make molten glass where it is typically combined with unused glass. This molten mixture is later poured into molds or blown into new glass products.

While recycling glass does not save much energy over making new glass from sand, it does have several advantages. Recycling glass requires relatively little water, creates no mining wastes and produces very little air pollution.

Just under 20% of all glass in the U.S. waste stream is recycled, while a healthy 70% of all glass is recycled in Maine, due in part to the state's bottle bill.

PLASTICS

Plastics are quite cumbersome to recycle, since the many different kinds that we discard into the waste stream, must be recycled separately. In general, however, all plastics are recycled by a similar process: First, they are separated by type according to the chasing arrow symbol embedded into the product (see chart below). They are chopped into small pieces, washed with soap and water, and

Plastic Container Code System

(voluntary code system developed by the Society of the Plastics Industry, Inc.)

Symbol	Abbreviation	Some of the Materials that use this type of container
1 PETE	PET (PETE)	polyethylene terephthalate - soft drink bottles
2 HDPE	HDPE	high density polyethylene - milk bottles, detergent bottles, orange juicebottles, some shopping bags
3 PVC	V (PVC)	vinyl (polyvinyl chloride) - shampoo bottles, salad dressing bottles, vinyl seats
4 LDPE	LDPE	low density polyethylene - shopping bags
5 PP	PP	polypropylene - catsup bottles, yogurt cups
6 PS	PS	polystyrene - foam cups, prescription bottles, plastic knives, forks, spoons
7 OTHER	OTHER	mixed or multiple layer plastics

dried. The plastics may be screened for impurities several times during the washing and drying process. The dry, uncontaminated plastic chips are then melted in a furnace and transformed into molten plastic which is pressed through a die, resulting in long strands of plastic. The strands are cooled in water and chopped into pellets. These pellets are later reheated and molded into new plastic products.

The fact that there are many different kinds of plastic *resins*, or *polymers*, used for plastic products -which must be recycled separately- contributes to the inefficiency of plastic recycling. The chasing arrow/number symbols used on plastic containers help consumers separate the resins for recycling, yet sorting plastics is expensive and a significant obstacle to recycling. Even some plastics made of the same resin must be separated for recycling because of the process used to make them (e.g. blow-molded HDPE laundry and soap jugs vs. injection-molded HDPE margarine containers.) Furthermore, some products are manufactured with two, three, or even four different kinds of plastic, which make resins very expensive to properly sort and recycle.

Plastics lose strength every time they are recycled as the long chains of molecules are broken into shorter and shorter pieces in the chopping and melting processes. This means that recycled plastics are almost always manufactured into "lower use" products. For example, soft drink bottles are usually made into detergent bottles, scouring pads, or polyester fiber. These products, in turn, can only be made into such things as plastic flowerpots or plastic lumber; these products may not be recyclable at all. Consequently, unused plastic must be used for all the new plastic soft drink containers and milk jugs that are produced; plastic recycling, in its current stage, is merely a partial solution to the problem of plastic waste management.

One hopeful development is the new concept of "design for disassembly" and "design for recycling." Manufacturers are beginning to create products which can be taken apart at the factory and the components easily separated for recycling. They are also designing these products to be made from materials that are more effectively recycled.

The difficulty of plastic recycling is evident. Nationally, a meager 2.2% of all plastics in the solid waste stream were recycled in 1990, mostly milk jugs and soda containers. Maine recycled over 15% of all plastic from municipal waste in 1991. While this is significant, it is still a much lower figure than that for most other materials.

Conclusion

Recycling is an important way for us to handle some of our solid waste. It provides some obvious benefits: It diverts waste from landfills at the same time that it conserves natural resources. Every ton of paper that is made from recycled fiber saves three cubic yards of landfill space and over three tons of wood. Markets for recyclable goods are a source of income for municipalities which must pay tipping fees. As these markets expand, municipalities should reap the benefits in the form of even higher prices for recyclable materials. Furthermore, recycling helps to make all of us aware of the waste we generate, and even may help us to produce less waste in the first place.

In the next decade, we may recycle nearly half of all the waste we generate in this country! While this is an admirable goal, recycling is not a cure-all. It has its costs, too. Consider that all 100,000 tons of metals, 7,000 tons of textiles, 45,000 tons of glass, and 12,000 tons of plastic collected for recycling in Maine in 1991 were transported out of the state for recycling. This transportation has significant environmental and economic costs! Recycling also requires time and commitment from consumers, and recycled products can be more expensive than the original products.

The benefits of recycling do outweigh the costs. Recycling rates are on the increase for nearly all materials in this country, and more people are recycling than ever before. There is still much work to be done! Ultimately, recycling needs to be seen for what it is: A way to retrieve valuable resources from the waste

stream after we have removed as much as possible by reducing, reusing and remanufacturing.

BIBLIOGRAPHY

Articles

1. "Recycling Plastics," by Hannah Holmes, *Garbage* Magazine, Jan./Feb. 1991, pp. 32-39.
2. "The Pain and Gain in Junk Plastic," by Mark Fischetti, ECO, June 1993, pp. 44-49.

Books and Pamphlets

1. *Waste: Choices for Communities*, edited by Susan Boyd, Burks Lapham, and Cynthia McGrath, Concern, Inc., September, 1988.
2. *The Global Ecology Handbook*, edited by Walter H. Corson, Beacon Press, Boston, MA, 1990.
3. *Characterization of Municipal Solid Waste in the United States, 1992 Update, Executive Summary*, U.S. EPA, July 1992.
4. *War on Waste*, by Louis Blumberg and Robert Gottleib, Island Press, Washington, D.C., 1989.
5. *Discarding the Throwaway Society*, Worldwatch Paper 101, by John E. Young, Worldwatch Institute, January 1991.
6. *Mining Urban Wastes: The Potential For Recycling*, Worldwatch Paper 76, by Cynthia Pollock, Worldwatch Institute, April 1987.
7. *The Solid Waste Mess: What Should We Do With the Garbage?*, by Gloria Danziger, Environmental Issues Forums, North American Association for Environmental Education, 1992.
8. *Recycling and the Maine Economy*, by Frank O'Hara, Market Decisions, Inc.; Mark Sullivan, and Martha Papp, Land & Water Associates; study for the Maine Waste Management Agency, April 1993.
9. *The Story and Uses of Aluminum*, The Aluminum Association, Inc.
10. *Aluminum Recycling: America's Environmental Success Story*, The Aluminum Association, Inc.
11. *Commercial and Institutional Steel Can Recycling*, Steel Recycling Institute.
12. *Recovered Paper Statistical Highlights*, 1992, American Forest and Paper Association.
13. *State of Maine Waste Management and Recycling Plan*, by Maine Waste Management Agency, April 1993.

Additional Resources

1. The Waste Watcher, Maine Waste Management Agency Newsletter, December 1992.
2. The Waste Watcher, Maine Waste Management Agency Newsletter, April 1993.
3. Greg Crawford, Steel Recycling Institute Foster Plaza, 680 Anderson Dr., Pittsburgh, PA 15220, (800) 876-7274
4. Susan Sherwood, American Forest and Paper Association
5. Rod Edwards, American Paper Institute, Paper Information Center 260 Madison Ave., New York, NY 10016, (800) 878-8878.
6. Paul Mara, The Aluminum Association 900 19th Street, NW, Washington, DC 20006, (202) 862-5156 (prefer written inquiries).

❹ Composting

Introduction

Decomposition is the name we give to the natural recycling of organic (living) matter. When a plant or animal of any kind dies, the remains become nourishment for other creatures and the surrounding soil. Thus, when leaves fall from the trees in autumn, they enrich the soil on the forest floor; when a deer dies in the forest, its carcass is consumed by coyotes, beetles, and ultimately, billions of microorganisms in the soil. In this way, valuable nutrients carried in the bodies of dead organisms are returned to the environment.

Composting, then, is a special form of decomposition. It is human-aided decomposition for the purpose of waste management. When we compost organic materials, we combine them in such a way and under such conditions as to optimize the natural process of decomposition. When the process is complete, the result is *finished compost* that weighs less and occupies less volume than the original waste. More importantly, the finished compost is a valuable soil amendment that has been sterilized by heat generated during decomposition and is thus free of pathogenic (disease) bacteria and weed seeds.

Where We Are Now

In Maine, one-third of all municipal solid waste is food and yard wastes, which can be easily composted. An additional one-third of our waste stream is paper, some of which can also be composted. This means that up to half of Maine's solid waste could be composted and thereby diverted from incinerators and landfills, and returned to the land in the form of finished compost. In 1991, only 10,790 tons of municipal waste were actually composted in Maine, or less than 1% of all municipal waste. This figure will increase dramatically as Maine achieves its goal of recycling and composting 50% of the municipal waste stream.

As of 1991, Maine was representative of the country as a whole; less than 1% of all municipal solid waste in the United States was composted in that year.

The Composting Process

In order for composting to be successful, the right conditions must exist. First, organic materials must be gathered to provide carbon and nitrogen in the proper amounts. Complex carbon molecules provide energy to the microorganisms that carry out the decomposition process. It is their 'food.' Nitrogen and simple carbon molecules are used to build the bodies of more microorganisms as they grow and reproduce.

For aerobic decomposition to occur, which is the fastest method of composting, oxygen is also necessary. This is usually provided by 'turning' the compost pile every few days. The oxygen is required for aerobic microorganisms to 'breathe.' If oxygen is not available, as in a compost pile that is not turned, *anaerobic* microorganisms take over the decomposition process. These microbes are slower to decompose the pile than the aerobic microorganisms, but given enough time, they, too, will produce finished compost. One disadvantage of anaerobic decomposition is that it tends to produce foul odors as it proceeds.

Finally, water is needed for successful composting. Since many of the materials that go into the pile already contain water (such as vegetable wastes), it may not be necessary to add more water. In any case, a moisture content of 40-60% is desirable, which is about the moisture content of a squeezed-out sponge. If the compost pile is saturated, necessary oxygen will dissolve in the water and become unavailable to aerobic bacterial decomposers.

Sufficient carbon, nitrogen, oxygen, and water provide favorable conditions for the reproduction of a variety of naturally occurring microbes that do the work of the aerobic composting process. In the first *psychrophilic* stage, simple bacteria that thrive in cool temperatures (45-60° F) secrete enzymes that allow them to consume easily available carbohydrates. This breakdown of organic matter produces carbon dioxide, water vapor, and heat, which causes the temperature of the pile to rise rapidly.

Background Information

4 Composting

When the temperature reaches approximately 70° F, conditions become unfavorable for cool-temperature bacteria, and they begin to die. In their place, warm-temperature *mesophilic* bacteria continue a similar decomposition process, generating more carbon dioxide, water vapor, and heat. The mesophilic bacteria thrive up to approximately 104° F, reproducing rapidly and continuing to consume carbohydrates.

Beyond 104° F, the mesophilic bacteria cannot survive, and conditions become optimal for high-temperature *thermophilic* microorganisms. These more complex bacteria, fungi, and molds continue to consume carbohydrates but also attack cellulose, lignin, and fats in the organic matter. This produces still more water vapor and heat, so that the temperature of the pile can reach up to 160° F and beyond. At approximately 158° F, conditions start to become unfavorable for even these thermophilic microbes to survive, so that temperatures over 160° F cannot be maintained for long periods of time.

It is very important that the pile gives off heat. First, higher temperatures in the compost pile increase the level of microbial activity, speeding up the decomposition process. Second, temperatures of 155° F effectively kill the harmful vectors (pathogens) of plant and human diseases that may have been present in the original materials, such as *Salmonella* and *E. coli*. Substantial heat also renders most plant seeds sterile, which means that finished compost will not sprout weeds wherever it is applied to the soil. Finally, high temperatures in the pile will help to keep harmful and annoying insects away and will prevent any of these insects from reproducing in the pile.

High temperatures persist in aerobic decomposition as long as there are sufficient amounts of carbon, nitrogen, oxygen, and moisture present. Of course, additional oxygen can be provided to the pile by turning, and water can be sprayed on the pile to keep it moist, but after several days, there will not be enough carbon or nitrogen to sustain a high level of microbial activity. Slowly, the temperature of the pile will decrease as these organisms produce less heat.

When the pile gets cool enough, *macroorganisms* such as earthworms, sowbugs, mites, millipedes, and beetles will move into the pile to continue the decomposition process. There is never a dull moment in the life of a compost pile!

We call the end product of the 'hot' composting cycle *finished compost*, although decomposition continues to take place slowly in the cooled-down pile. Finished compost is a dark, earthy, crumbly substance with a pleasant aroma. It is made up of partially decomposed organic matter, billions of living microbes (which continue to carry out the process of decomposition) microbial skeletons, inorganic particles, and perhaps most importantly, *humus* (pronounced HYOO-muss).

Humus is the substance in finished compost that is chiefly responsible for providing nutrients to plants. It is extremely complex in its composition, being made up of many different compounds organized in many different ways. Among its constituent parts are an assortment of proteins and a wide variety of acids (called *humic acids*). However, no two humus particles are exactly the same. Humus is the ultimate end-product of decomposition in the sense that it is constructed from those portions of organic matter that are resistant to further breakdown.

Plants, Soil, and Compost

Compost provides many things to plants which foster healthy growth. Perhaps most importantly, compost supplies plants with nutrients: mineral nitrogen, which plants use as the protein building blocks of their bodies; common but necessary minerals such as phosphorous and potassium; and trace elements such as zinc and magnesium. These nutrients help plants to thrive and produce healthy fruits and vegetables, colorful flowers, and full foliage.

Compost also helps plants by improving soil structure. It lightens dense soils and provides organic matter, increases water retention, and improves aeration in any soil. Among other things, this allows good plant root growth, provides favorable conditions for healthy soil bacteria, and helps plants survive times of drought.

Compost benefits soil and plants in many other ways, too. It acts as a sort of 'buffer' for soils by making plants less sensitive to soil acidity or alkalinity. It also helps soil to absorb heat from sunlight, which can result in a longer growing season. It provides excellent protection against soil erosion. It can actually destroy toxic waste in soil. Finally, it promotes the growth of helpful soil bacteria, including some that produce soil antibiotics against common plant pathogens.

How and Why?

One efficient way to make compost is to maintain a pile in the backyard. Compost can be successfully produced from ordinary yard wastes including grass clippings, fallen leaves, and food scraps. This is highly efficient because it does not require transportation of materials or heavy machinery, and because most nutrients are returned to their source, namely, your backyard. There are several styles of backyard composters, some are inexpensive. Refer to the diagrams in the Pathway to Action: Cafeteria Composting Project, or the references listed here. Cooperative Extension's booklet Composting to *Reduce the Waste Stream has several good alternatives.*

Some municipalities have developed solid waste composting projects, including mixed waste composting and yard and leaf waste composting. As of 1992, there were 21 facilities in the U.S. that were composting unseparated municipal solid waste. Since composting mixed household trash creates many technical problems, Maine officials prefer source-separated composting. Nationwide, there were nearly 3,000 facilities composting leaves, grass, brush, and other yard trimmings. In 1992 Maine had 22 such programs.

Conclusion

Composting is one way that we can begin to manage our waste with an efficient natural process. It is an inexpensive and environmentally sound method that can be used to turn a large percentage of our waste into a useful commodity. It is also practical on a small scale. In these ways, it is an improvement on many current waste disposal methods such as landfilling and incineration. As the waste disposal problem in our state and in our nation continues to grow, we must aggressively use composting as a major means for managing organic wastes.

4 Composting

BIBLIOGRAPHY

Articles

1. "Making and Using Compost," by Susan Glaese, *Mother Earth News*, September/October 1986. pp. 46-51.
2. "Backyard Composters," by Jay Burnett, *Organic Gardening*, April 1988, pp. 82-86.
3. "On Farm Composting," by Robert Rynk, Engineering Notes, Cooperative Extension, University of Massachusetts, May 1988.
4. "Why Hot Compost Is Best," by Anthony DeCrosta, *Organic Gardening*, August 1980, pp. 74-77.
5. "Rot Is Hot," by William Bryant Logan, *The New York Times Magazine*, September 8, 1991, pp. 46-52.
6. "Composting Municipal and Household Organic Wastes," by Floyd V. Barker, University of New Hampshire Cooperative Extension Service.
7. "Composting, from Backyard to Big-Time," by Janet Marinelli, *Garbage*, July/August 1990, pp. 44-51.
8. "Compost," by Robert Kourik, *Garbage*, October/November 1992, pp. 44-48.
9. "The State of Garbage," by Robert Steuteville and Nora Goldstein, *BioCycle*, May 1993, pp. 42-50.

Books and Pamphlets

1. *The Complete Book of Composting*, by J. I. Rodale, Rodale Books, Inc., Emmaus, PA, 1975.
2. *Backyard Composting*, edited by John W. Roulac, Harmonious Press, Ojai, California, 1992.
3 *Composting to Reduce the Waste Stream*, by N. Dickson, T. Richard, R. Kozlowski, Northeast Regional Agricultural Engineering Service Cooperative Extension, January 1991.
4. *Encyclopedia of Earth System Science*, Volume 3, edited by William A. Nierenberg, Academic Press, Inc., Harcourt Brace Jovanovich, San Diego, CA, 1992.

5 Incineration

Introduction

Incineration, the process of burning waste to reduce its volume and weight, has long been practiced in the United States. The first U.S. incinerator began to operate in 1885 on Governor's Island, New York as an alternative to the direct dumping of waste. Since that time, many incinerators have also used the energy released from burning waste to generate steam or electricity as a by-product, employing aptly-named "waste-to-energy" technology.

Incinerators have often been hailed as the best solution for solid waste disposal, but concerns persist today over this technology. While burning waste reduces it by 60-90% in weight and volume, the ash residue must still be buried or disposed of in some fashion. Furthermore, this ash and the gases released during incineration can be toxic to humans and the environment unless properly treated with pollution control devices. And incineration is an expensive method of dealing with waste, from the construction of the incinerator itself to the daily maintenance and operation of the plant.

Where We Are Now

Nearly 17% of all municipal solid waste generated in the United States in 1990 was incinerated. This represents a decrease from the 1960s when nearly one-third of all waste in the U.S. went up in flames, but an increase since the late 1980s, when less than ten percent of U.S. waste was burned. Incineration has fluctuated in prominence throughout its history in this country, largely due to changing public perceptions about its safety. In recent years, improving pollution control technology has led to a resurgence in incineration as a waste management strategy. As of 1989, there were 167 incinerators operating in the United States, with 25 more under construction and 94 in the planning stages. By 1995, it is estimated that incinerators will handle 20% of the municipal solid waste stream.

The vast majority of existing incinerators employ waste-to-energy technology. Over one million homes in the United States use electricity that is generated in waste-to-energy plants, and this number is increasing.

Maine incinerates a large portion of its waste. In 1991, 37% of Maine waste was incinerated, over double the national average. This means more waste is incinerated in the state than landfilled!

Four of Maine's five incinerators operating in early 1993 were waste-to-energy plants. According to a spokesman, Regional Waste Systems in Portland, for example, generates 20% of the residential electricity demand for its 20 member municipalities, nearly 100,000 megawatt hours each year.

What Happens in an Incinerator

There are two major kinds of incinerators operating in the United States today. Both kinds can burn up to 3,000 tons of waste per day. Three-fourths of all incinerators are called *mass burn* incinerators. These plants burn virtually the entire waste stream, including metals and glass, in high-temperature furnaces. Only a tiny fraction of the waste stream is culled out before incineration, including *white goods* such as discarded refrigerators and washing machines and any obvious hazardous materials such as automobile batteries. These rejected materials are recycled or sent to landfills for disposal.

Refuse-derived fuel (RDF) incinerators cull out 5-8% of the waste stream before incineration with a series of sorting machines. As waste is delivered to the facility, it is put on a conveyor belt and passed through a series of grinders and hammers which smash the waste into small pieces. Strong magnets separate out ferrous metals and complex screen systems cull out glass and other noncombustible materials for recycling or appropriate disposal. The remainder of the waste, made up of mostly plastics, paper, and other organic materials, can be stored or burned in a high-temperature furnace. In general, RDF plants are more expensive to operate than mass burn incinerators, due to the additional machinery that they require. However, they provide a more efficient fuel for incineration than mass burn plants, and RDF plants can recycle the materials that are culled out of the waste stream.

Background Information

5 Incineration

The furnaces in both mass burn and RDF incinerators operate on the same principles. Waste materials are fed into a furnace on a conveyor belt where they burn at high temperatures in an oxygen-rich environment. Ash drops to the bottom of the furnace (called *bottom ash*), is cooled, and is mechanically removed. Heat, gases, and airborne particles (called *fly ash*) that are produced in the combustion process flow through a series of pollution control devices and are filtered out or released into the air. The ash that is produced in the incineration process is usually buried separately in specialized landfills called *monofills* or *ashfills*.

In waste-to-energy incinerators, the heat that is generated from burning wastes heats up a boiler which produces steam. As in most nuclear, oil, and coal-fired power plants, this steam is then used to drive a turbine, which produce electricity.

Incineration Hazards

Incinerators utilize extensive modern technology to operate safely and within environmental safety limits. However, they are *potentially* hazardous in a variety of ways. Both the smoke generated by burning waste and the ash leftover after incineration have many hazardous components. The smoke contains large quantities of several gases that are considered atmospheric pollutants. They include carbon monoxide, nitrogen dioxide, sulfur dioxide, and a variety of hydrocarbon gases which are major contributors to urban smog and acid rain.

The smoke from waste combustion also contains toxic *heavy metal* ions such as lead, mercury, and arsenic. When metallic wastes such as batteries are incinerated, some of the metals are transformed from relatively stable forms to unstable, free ions. In this form, they are quite toxic to humans; most are believed to be carcinogenic and many have been linked to a variety of other digestive, nervous, and respiratory disorders.

Thirdly, the smoke in an incinerator furnace contains minute amounts of other hazardous gaseous compounds, most notably *dioxins* and *furans*. These are chemicals that are believed to be among the most toxic chemicals in the world, producing adverse health effects in animals even in extremely low concentrations.

In addition, smoke from waste combustion contains a variety of particles which are carried by the hot, rising gases. Some of these particles are actually airborne ashes, called *fly ash*. Studies have shown that heavy metals and dioxins can adhere to ash and other particulates in significant quantities. All airborne particles (*particulates*) less than 10 microns wide are a health hazard on their own, too, contributing to a variety of respiratory diseases in humans and animals.

Finally, when ash is landfilled, it is fairly stable, but it can pose the same problems of leaching contaminants into ground and surface water that municipal solid waste landfills pose. The ash that is produced in the incineration of municipal solid waste is also toxic; both *bottom ash*, collected from the bottom of the furnace after incineration, and fly ash. Both fly ash and bottom ash contain toxic compounds.

Pollution Controls

Fortunately, the potential hazards of incineration can be controlled in a variety of ways. Each individual incinerator is managed differently, but all are required to meet certain pollution standards designed to protect public health. Pollution standards are set by the EPA on a national level, but many states, including Maine, set their own, tougher standards. As of 1993, maximum permissible levels for seven *criteria pollutants* in incinerator emissions had been identified by the EPA. (While there are more than seven toxic substances produced in incineration, these seven pollutants serve as indicators of the overall cleanliness of the emissions.) The methods of pollution control mentioned here are some of the most common methods used in incinerators.

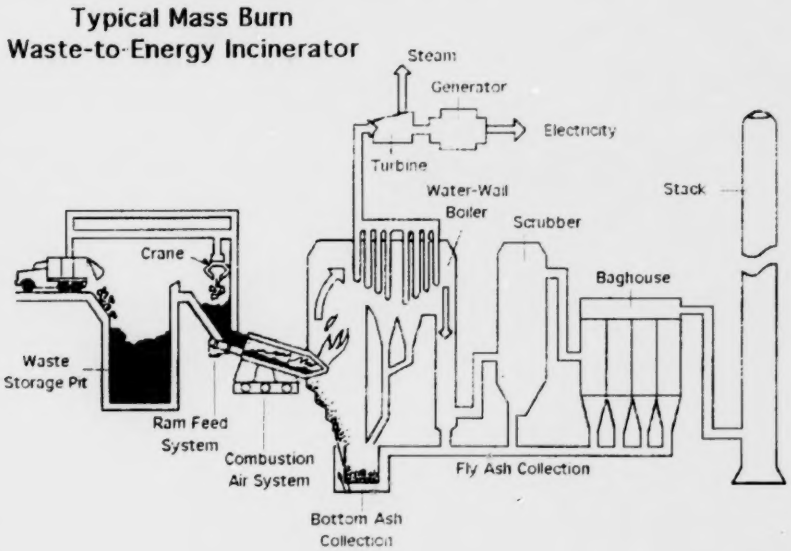
First, metals and other materials that may become toxic if burned can be separated out of the waste stream before combustion, as in RDF incinerators. This ensures a more efficient fuel source for these incinerators which produce less harmful emissions.

Secondly, a high temperature can be maintained in the furnace, which encourages complete combustion of all materials. Air can be forced into the furnace by huge fans that keep the fire raging. The gases released in complete combustion are less toxic than fumes from 'low' temperature combustion; in particular, high temperatures are less likely to produce dioxins.

The gases that are released during even the most complete combustion are still harmful, however, and they contain toxic fly ash and other particulate matter. In all incinerators, they pass through a series of *scrubbers* which make the gases safe enough to be emitted into the air. There are many different types of scrubbers. *Wet/dry scrubbers* spray a limewater slurry into the hot gases as they emerge from the furnace. The calcium in the lime reacts with any acid gases and transforms them into relatively harmless solid compounds which can be collected and landfilled. *Baghouse filters* mechanically filter particles out of the incinerator exhaust. *Electrostatic precipitators* remove particles by means of a powerful electric charge.

Through a variety of methods, then, the emissions from incinerators are made safe enough to meet pollution standards. Unfortunately, all the hazardous materials (e.g. heavy metals and dioxins) that are filtered out of the **gases** by pollution control devices end up in the **residues** leftover after the incineration process is complete (bottom ash, fly ash, calcium compounds, particulates, etc.). Scrubbers do not eliminate pollutants; they merely capture them before they can be emitted into the air. This makes it clear why incinerator ash and other residues must be disposed of appropriately, in secure facilities.

Typical Mass Burn Waste-to-Energy Incinerator



U.S. Environmental Protection Agency

Note: The illustration represents a typical mass burn incinerator. Refuse Derived Fuel (RDF) incinerators use a process which differs dramatically at the "front end." RDF plants separate the waste and remove recyclables before the fuel enters the incinerator.

5 Incineration

Incineration Costs

Incineration has typically been a very expensive method of waste management. The cost to construct a large new incinerator that will meet all EPA and state regulations can run into the hundreds of millions of dollars. Incinerators have high operating costs, too, due to the complex machinery that they require and the expenses associated with ash disposal. These costs can be partially offset by electricity generation in waste-to-energy plants, but incinerators receive income by charging a *tipping fee* to dump wastes at the incinerator. Because incinerators are expensive to operate, tipping fees charged at incinerators tend to be higher than those charged at landfills. In Maine, tipping fees are similar for both landfills and incinerators. The four large incinerators in the state charge an average tipping fee of $45 per ton (1993); the largest landfills in the state charge tipping fees of approximately $55 per ton.

Conclusion

Incineration can be an alluring method of waste disposal. By reducing the volume of waste that must be landfilled, it provides a partial solution to the pressing problem of landfill shortages. It can produce energy as a by-product. However, some argue that incineration works against more important source reduction and recycling efforts because incinerators require huge volumes of garbage every day to keep operating. For example, many incinerators require towns that bring their waste for incineration to sign 'put or pay' contracts which guarantee that the towns will deliver the same amount of trash every year or pay for it anyway. Thus, incineration does not encourage us to change our lifestyles to produce less waste. Furthermore, it requires expensive technology to be safe and, like most major industrial operations, it does carry some risk. How much risk it carries is hard to quantify accurately. Certainly as the technology in incineration improves, it will become safer.

BIBLIOGRAPHY

Articles

1. "Managing Solid Waste," by Philip O'Leary, Patrick W. Walsh, and Robert K. Ham, *Scientific American*, December 1988, pp. 36-42.
2. "Incineration: The Illusive Panacea," by Tamara Risser, *Habitat*, March 1987, pp. 21-25.
3. "The Role of Incineration in Integrated Waste Management - The Total Story," by K. C. Lee, article for presentation at the 1991 West Virginia Earth Day Symposium, April 20, 1991, published in the Coalition for Responsible Waste Incineration Information Kit.

Books and Pamphlets

1. "Incinerator Ash," by Marquita K. Hill, Chemicals in the Environment Information Center, University of Maine Cooperative Extension, December 1991.
2. *War on Waste*, by Louis Blumberg and Robert Gottlieb, Island Press, Washington, D.C., 1989.
3. *The Global Ecology Handbook*, edited by Walter H. Corson, Beacon Press, Boston, MA, 1990.
4. *Waste: Choices for Communities*, edited by Susan Boyd, Burks Lapham, and Cynthia McGrath, Concern, Inc., September 1988.
5. *Characterization of Municipal Solid Waste in the Unites States, 1992 Update, Executive Summary*, U.S. EPA, July 1992.

Additional Resources

1. Interviews with Eric Root, Director of Material Recovery, Regional Waste Systems, Portland, Maine, April 9 and 14, 1993.
2. "The Waste Watcher", Maine Waste Management Agency Newsletter, December 1992.
3. Additional statistics from the Maine Waste Management Agency.

6 Landfilling

Introduction

Land disposal is the oldest and most common form of waste management in the United States. Until the second half of this century, waste was deposited in *open dumps*, literally exposed piles of garbage; today waste is taken to specific *landfill* sites for disposal. When wastes are taken to a landfill, they are dumped, compacted, and covered with soil. Over a long period of time, materials may begin to decompose in the landfill, but in general, the wastes remain in the ground more or less intact for many years. Studies have found perfectly legible newspapers that have survived for two decades in landfills, next to whole apples and chicken bones with meat still on them!

While land disposal has been the solution to our waste problems for many years, they have always presented a number of problems to people and the environment. They can produce odors, provide a breeding ground for undesirable insects and disease, attract animals, and contaminate air, water, and soil. These problems were rampant in the open dumps that existed throughout the country in the early 20th century, although most concerns can be addressed today through modern technology. Even the most technologically advanced landfills, however, have a significant impact on their local environment.

Where We Are Now

In recent years, the amount of available landfill space in the United States has decreased rapidly. This has happened for three reasons: 1) many existing landfills have reached maximum capacity and have been forced to close due to lack of space; 2) many existing landfills, opened before strict federal and state regulations were in place, have been shut down based on environmental concerns; 3) strong public opposition has prevented the construction of many new landfill facilities that will meet all regulations. Fifteen years ago, over 20,000 landfills existed in the United States. In 1992, there were fewer than 5,000.

This decline in landfill space nationally is quite alarming in light of the fact that the amount of trash Americans produce continues to increase every year, and according to BioCycle magazine, in 1992 over 70% of this municipal solid waste was destined for landfills.

Maine has managed to buck this national trend to some extent. While the state has closed most landfills which don't comply with environmental regulations, landfills in Maine receive only 35% of the state's municipal solid waste, about half the national average. This is due to Maine's high rates of incineration and recycling. Furthermore, the total amount of waste generated annually in Maine has decreased slightly in recent years.

The Maine Waste Management Agency projects that the state will continue to landfill less and less waste in the future as incineration and recycling continue to increase. The state goal for 1994, was to landfill just 15% of its municipal waste.

Landfilling Costs

One reason land disposal has historically been the primary method of waste management in the United States is that it was inexpensive. Before federal and state governments began to regulate landfills, trash was dumped in city or county dumps for nominal fees. Today, landfills must be designed, constructed, managed, and monitored with expensive equipment and heavy machinery. A 1990 study conducted for the state of Michigan estimated development and construction costs for a state-of-the-art 80-acre landfill to exceed $30 million! Operation costs can approach hundreds of thousands of dollars annually, and closure and post-closure costs have been estimated at nearly $5 million over thirty years. In short, landfilling is no longer cheap! As a result, landfill *tipping fees*, the prices charged for dumping trash in landfills, are increasing in most parts of the country. Maine's largest modern sanitary (or secure) landfills charge tipping fees of approximately $55 per ton.

6 Landfilling

What Happens in a Landfill

Wastes are generally delivered to modern landfills in garbage trucks. Wastes are dumped, compacted, piled ten to thirty feet high and covered with soil. At the end of each day, any exposed waste is covered with additional soil. In this way, wastes are buried in *cells*, distinct areas separated by soil. After the entire surface of the landfill is covered with one layer of waste, additional cells can be constructed on top of the wastes. Some landfills are built up nearly 100 feet above the level of the surrounding land. When a landfill reaches capacity, it must be covered with several additional feet of topsoil, and the surface can be replanted with vegetation. Many closed landfills have been used as parks, golf courses, or recreational areas.

Landfill Hazards

Most landfills pose the threat of contaminating groundwater, especially in Maine where there is a high water table and regular precipitation. When rainwater percolates through the materials in landfills, it becomes contaminated and seeps into the ground below as *leachate*. The leachate becomes acidified in the landfill through biochemical processes and consequently can carry toxic materials out of the wastes and into the ground. In particular, heavy metal ions can be leached out of wastes and into groundwater, streams, or lakes.

Some decomposition of wastes does occur in landfills. One by-product of this biological breakdown is methane gas. Methane is an atmospheric pollutant, is potentially explosive, and can kill vegetation on closed landfill sites by starving plants of oxygen. Other gases that are produced by the biological breakdown of wastes include carbon dioxide and hydrogen sulfide.

There are other less serious nuisances caused by landfills. If they are not properly maintained, they often attract animals who scavenge for food. They can also produce odors and are unsightly additions to any landscape while in active use.

The Modern "Secure" Landfill

Modern landfills are sometimes referred to as secure landfills due to their sophisticated design which aims to minimize environmental risks. Under current EPA regulations, new landfills are required by law to be constructed with a clay and/or plastic *composite liner* on the bottom which will be impermeable to leachate. Landfills that have this liner are called *secure* landfills. Rainwater can also be diverted from the landfill with the installation of plastic caps or covers, which helps to minimize leachate formation. Any leachate that does form in 'secure' landfills must be collected in pipes at the bottom and pumped up to the ground for treatment. Modern landfills are also required to have wells drilled adjacent to the site which are monitored for any signs of contamination.

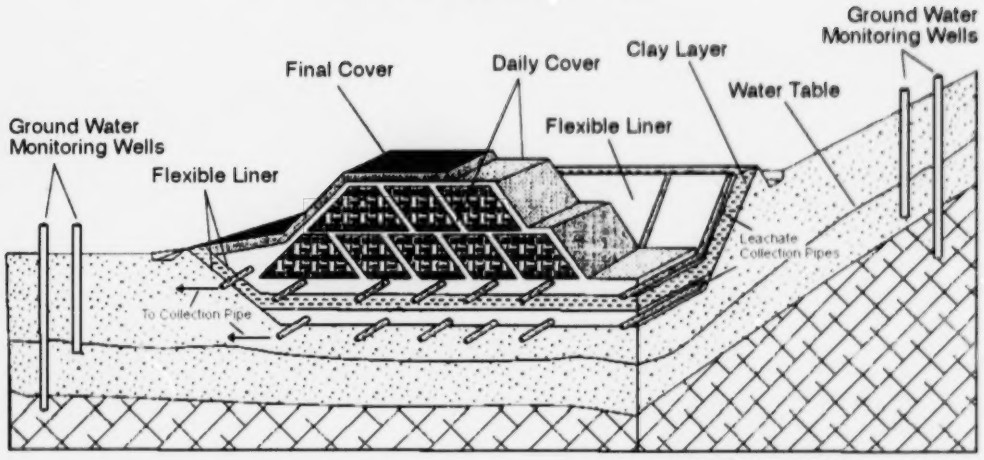
Methane gas management is also regulated by the EPA. At most landfills, methane production is simply monitored to insure proper venting into the atmosphere. Some landfills collect methane and burn it off as a waste product; a few landfills even collect the methane to burn for the purpose of generating electricity.

Unfortunately, these and other technological advances are not standard features on all landfills. Current EPA regulations notwithstanding, many landfills that opened years ago continue to operate without any means of controlling leachate or methane. As of 1988, before the current EPA regulations went into effect, it was estimated that only 25 percent of existing U.S. landfills monitored groundwater for leachate contamination, only 15 percent had clay or synthetic liners, and just 5 percent collected leachate for treatment.

Conclusion

The technology that is making landfills safer and less offensive is truly a double-edged sword. It makes disposing of wastes in the ground environmentally acceptable, but accepting this convenient method of discarding our refuse may blind us to alternative waste management strategies such as recy-

Modern Secure Landfill



Siting Office, Maine Waste Management Agency

cling and composting which may ultimately be more environmentally sound. Furthermore, as sanitary landfill technology becomes more sophisticated, environmental protection will come at a higher price.

Ultimately, no amount of technology will change the fact that landfills put valuable resources into the ground where they cannot be reused. It is only when we put materials into the ground that they truly become 'waste.' Landfilling, then, is really a last resort for dealing with solid waste. According to the EPA, it is the least attractive method of waste disposal after waste reduction, reuse, recycling, composting, and incineration. The days of dumping waste because it is simple and cheap are long since over.

BIBLIOGRAPHY

Articles

1. "Closure and Post-Closure Costs," by Robert T. Glebs and Ted Juszczyk, Waste Age, March 1990, pp. 40-48.
2. "Sanitary Landfill Costs, Estimated," by James Walsh, Waste Age, March 1990, pp. 50-54.
3. "Caught by the Rising Tide," by Donald M. Kreis, Habitat, March 1987, pp. 12-16.
4. "Managing Solid Waste," by Philip O'Leary, Patrick W. Walsh, and Robert K. Ham, Scientific American, December 1988, pp. 36-42.
5. "The State of Garbage," by Robert Steuteville and Nora Goldstein, BioCycle, May 1993, pp. 42-50.

Books and Pamphlets

1. *Landfills and Municipal Solid Waste in Maine*, by George K. Criner, John M. Halstead, Elizabeth Curtin, and Steven C. Deller, Maine Agricultural Experiment Station, University of Maine, Bulletin 835, August 1991.
2. *War on Waste*, by Louis Blumberg and Robert Gottleib, Island Press, Washington, D.C., 1988.
3. *Waste: Choices for Communities*, edited by Susan Boyd, Burks Lapham, and Cynthia McGrath, Concern, Inc., September, 1988.
4. *Characterization of Municipal Solid Waste in the United States, 1992 Update, Executive Summary*, U.S. EPA, July 1992.
5. *The Global Ecology Handbook*, edited by Walter H. Corson, Beacon Press, Boston, MA, 1990.

Additional Resources

1. Interview with John James, Office of Siting, Maine Waste Management Agency, April 8, 1993.
2. "The Waste Watcher", Maine Waste Management Agency Newsletter, December 1992.

Background Information

Household Hazardous Wastes

Introduction

Any material is considered hazardous if it is reactive, ignitable, toxic, radioactive, or has dangerous biological characteristics. Hazardous wastes have been front-page news for several years and strict federal laws are now in place to regulate the disposal of hazardous wastes produced by industrial and commercial generators. Hazardous wastes produced at home are exempt from federal or state disposal regulation, yet there are few local facilities or programs which allow homeowners to safely dispose of their hazardous wastes. As a result, the disposal of household hazardous waste in household trash or sewage systems can contaminate the air, soil, and groundwater.

All citizens must understand the dangers of improper waste disposal and work to create acceptable disposal options. The most effective strategy to address household hazardous wastes is to reduce the amount of wastes produced in the first place and to reduce the toxicity of those wastes. There are many effective alternatives to hazardous materials used in the home to help us all reduce household hazardous wastes at home and at school.

Where We Are Now

The average American generates 15 pounds of household hazardous waste each year. This accounts for 1-2% of the municipal solid waste generated in the United States. Because these wastes are exempt from federal and state hazardous waste regulation, most of this waste goes improperly to local disposal facilities, sewage treatment plants, septic systems, or down storm drains. These disposal methods pose environmental and public health problems.

Some states are making efforts to reduce the environmental impact of household hazardous wastes by eliminating certain wastes from landfills, by setting up material-specific collections, by educating consumers, and by requiring manufacturers to reduce the hazardous material content in consumer products. Collection programs for hazardous materials have been initiated in many states and communities around the country. Maine has a number of local service stations which collect and recycle waste oil. There are new regulations for manufacturers to reduce the heavy metal content in alkaline, nickel-cadmium (ni-cad), and button batteries. A few towns in Maine have conducted hazardous waste collections, yet there are no regular community collection programs for hazardous wastes. Maine law requires the Maine Waste Management Agency to develop a plan for collecting hazardous wastes from households and small quantity generators by July 1, 1995, yet this program has gone unfunded.

Production and disposal of hazardous wastes are as much a problem in schools as they are for households. Schools use household and industrial strength cleaners, solvents, polishes, paints, and pesticides which can be hazardous to custodial staff, teachers, and students. These materials must be disposed of properly to avoid contaminating the environment. In addition, schools often stock hazardous chemicals for science, art, or vocational classes.

Since state and federal laws protect employees in the workplace, hazardous materials in all schools are regulated by the Occupational Safety and Health Administration (OSHA) and monitored by the Maine Department of Labor and the Department of Education. The Industrial Safety Division of the Department of Labor provides training for school personnel involved with the handling and disposal of hazardous substances.

In 1989, the Bureau of Public Improvement initiated a major hazardous materials clean-up in Maine schools. This process required each school to inventory hazardous materials and remove unnecessary chemicals and dangerous products. Many extremely hazardous and potentially explosive materials were removed from storerooms and guide-

lines were established to limit the re-accumulation of these materials. Now, school officials are required to list all hazardous materials used in each building and update the inventory annually. Schools are not allowed to purchase more than a 2-year supply of any hazardous substance and are required to inventory household products purchased in industrial quantities (case lots.) Usually the supervisor of buildings and maintenance for the school district or the transportation manager keeps the inventories along with the required Material Safety Data Sheets for each hazardous substance or product.

What Materials Are Hazardous?

Most information on household hazardous waste considers only hazardous materials which are corrosive, reactive, flammable and/or toxic. Radioactive and infectious biological wastes are not usually considered in the *household* hazardous category although there are some consumer products that contain small amounts of radioactive material, notably smoke detectors. Manufacturers of household smoke detectors are required to accept used units for disposal. Televisions actually produce small amounts of ionizing radiation (X-rays), though they are not radioactive themselves. For infectious wastes, the health care industry has strict guidelines to prevent the spread of AIDS, the Hepatitis B virus, or other biohazards. School personnel are trained to handle biological wastes that could possibly be encountered in school settings. Baby diapers and other sanitary products are also potentially infectious waste. The corrosive, reactive, flammable and/or toxic materials usually considered as household hazardous waste are much more common and problematic in home and school settings.

Hazardous materials are classified according to their harmful characteristics. Many products have more than one of these characteristics:

Corrosive materials destroy metal surfaces or burn living tissue. They can be highly acidic or caustic. Examples include drain cleaners, toilet bowl cleaners, oven cleaners, batteries, pool chemicals, and chlorine bleach.

Reactive materials can generate heat and become explosive when they react with substances around them, and may create toxic fumes. Examples include picric acid (used in some science labs) welding material, certain pesticides (zinc phosphate), and bleach cleaners.

Flammable materials can burst into flames when they come in contact with sparks or flames. They have a flash point of less than 140° F. Examples include motor oil, gasoline, oil-based paints and lacquers, paint strippers and thinners, some nail polishes, hair sprays, and other aerosol products.

Toxic materials cause illness, injury or death through ingestion, inhalation, or absorption. They can cause immediate or long term health problems. Examples include paint stripper, pesticides, antifreeze, wood preservatives, furniture polish, and silver polish.

For practical identification, household products are often grouped into Cleaners, Car Products, Pesticides, Paints and Solvents, Other Household Products (batteries, fingernail polish, rubber cement.

Household hazardous products can cause problems both when they are being used and when they are discarded. Precautions should be taken to prevent exposure to dangerous products, especially by following recommendations for ventilation and preventing exposure to skin or eyes. Material Data Safety Sheets (MSDS), which detail use and disposal procedures, are available for most commercial products. Flinn Scientific has developed MSDS's for science teachers (P.O. Box 219 131 Flinn St., Batavia, IL 60510-0219, 321-879-6900.) Labels on household products provide much of the same information as the MSDS, although in less detail, and usually include a telephone number for more information.

Background Information

Household Hazardous Wastes

Household Hazardous Waste Disposal

Unfortunately, most household hazardous wastes end up being thrown out with the regular trash, poured down the drain, dumped on the ground, or dumped down a storm sewer. These unsafe disposal methods are extremely harmful to the environment and can contaminate septic systems, surface water, or groundwater.

The only approved methods for disposal of most hazardous wastes are to recycle or reclaim them, to incinerate them in a hazardous waste incinerator, to neutralize the components chemically or biologically, or to solidify or stabilize the waste through chemical reaction before it is landfilled. This disposal is done at licensed hazardous waste facilities using the appropriate technology for each specific hazardous material. Recent studies indicate that people downwind of hazardous waste incinerators have developed a variety of health problems. Although there are no conclusive links, researchers suspect there are dangers associated even with the "approved" disposal of hazardous waste (Science News, 1993.)

The Worst Offenders

Although *Waste Oil* is not a hazardous substance in the legal sense, it is a waste of special concern. Waste oil is the largest single source of oil pollution in U.S. waterways as most improperly disposed oil eventually finds its way into water sources. Oil discarded in landfills can leach into groundwater. Oil dumped on the ground or in storm drains can contaminate ground water and surface water.

Waste oil can be used as fuel in waste oil furnaces and can be recycled. In Maine, oil is collected by many businesses, auto service stations, and recycling centers. At some collection sites a fee may be charged for accepting waste oil.

Waste Paint accounts for 50-80% of the hazardous waste dumped by individual households. When disposed of improperly, paint can pose serious threats to human health and the natural environment. Latex paints are less hazardous than oil-based paints, but they still contain toxic substances and should be handled carefully. Reduction, reuse, and recycling are the only practical methods available for disposing of waste paint, and these methods are generally available only for latex paints. Communities or civic groups can set up paint exchanges or collect latex paints for mixing and reusing. If those programs are not available, it is recommended to use up excess paint or give it to someone who can.

Most of the 2.7 billion household batteries used by Americans each year end up in household trash which is landfilled or incinerated. Many batteries contain heavy metals such as mercury, cadmium, lead, and zinc. Currently, there are no collection programs for household batteries, but a Maine law has been passed (1992) that requires manufacturers to reduce the amount of mercury allowed in alkaline batteries. The law also bans mercury-oxide (button) batteries (1993) and bans the addition of any mercury in the manufacture of alkaline batteries by 1996. Large users like communication facilities and hospitals are required to collect and recycle mercuric oxide button, rechargeable nickel-cadmium, and rechargeable small sealed lead-acid (used in emergency lighting) batteries.

What Else Can Be Done

The safest method of dealing with hazardous waste is not to create it in the first place. Many industries are finding alternatives to using hazardous materials in manufacturing. Consumers can find less toxic alternatives to many of the products they use. Schools as well should avoid hazardous products and find alternatives which will not harm the environment.

Taking Inventory: Before consumers can reduce their use of hazardous materials, they need to know what hazardous materials they have on hand and what hazardous waste they produce. An inventory of the hazardous substances in the home or at school is

essential. At school, the hazardous materials inventory should be on file and is required to be updated annually. Often, miscellaneous cleaners or art materials are not counted in the school inventory. These can be added to make a complete listing of hazardous materials in the school.

Safety precautions should be taken during any inventory of hazardous materials. Students should be supervised by an adult. Do not open any containers; instead, use the information on the product labels. Do not shake containers. Be sure the materials are being stored properly. In school, consult a Material Safety Data Sheet for each chemical in the storerooms.

Purchasing: Buy products that are non-toxic, read the labels, and compare products. Use non-toxic alternatives, since specialized products are often unnecessary. Buy only the amount of material that you need for the job. Buy non-aerosol products since aerosols create mist which can be inhaled and can be harmful.

Product Use: Use products in well ventilated areas and avoid breathing fumes. Wear protective clothing. Never mix products, such as ammonia and chlorine bleach, two common chemicals in cleaning products, which when combined produce deadly fumes. Use only the recommended amount for each job.

Storage: Store household chemicals in a safe place and keep them away from children. Keep containers securely closed. Keep products in their original containers. If containers leak or corrode, place the old container and contents in another, leak-proof container.

Disposal: Use a product completely so there is nothing leftover to throw away. Donate leftover paints to a charitable group or another school, making sure the package is well labeled. Take used oil to an oil recycler (service station) near you. Collect rechargeable, ni-cad, and small sealed lead-acid batteries for recycling. Never pour harmful chemicals down the drain or on the ground.

The only appropriate disposal of most hazardous materials is through a licensed hazardous waste hauler at an approved facility. Schools and school districts can contract with a licensed hauler to remove hazardous materials for safe disposal.

Organize a community hazardous waste collection program. If there is strong community support, single-day-collections can be arranged by contracting with a licensed hazardous waste hauler. The Department of Environmental Protection recommends contacting their Licensing and Enforcement Division for guidelines to organize the collection day. Collection days can be very expensive because of the disposal costs of hazardous materials, but they are an important step towards removing hazardous products from the home. Contact the Maine Waste Management Agency to determine the current status of other hazardous waste collection programs.

Conclusion

Hazardous wastes have become a problematic component of the waste stream. Once created, they are expensive to dispose of and difficult to handle properly. Therefore, the best strategy for reducing the dangers of hazardous wastes in the home and in school is to avoid the purchase and use of products which contain hazardous materials. There are non-hazardous alternatives for most of these products.

To the extent that hazardous materials are necessary, they should be completely used, recycled, or disposed of through a licensed handler. Proper disposal of these materials will protect land, water, and people from pollution. We must all take responsibility to reduce our dependence on hazardous products and ensure the proper disposal of hazardous wastes.

Household Hazardous Wastes

BIBLIOGRAPHY

Curriculum Guide

Teaching Toxics, Creating Solutions to Household Pollution, Association of Vermont Recyclers, Montpelier, VT 1992.

Government Regulation Documents

Handbook for Maine's Hazardous Waste Generators, Maine Dept. of Environmental Protection, Augusta.

Maine Bureau of Labor Standards Hazard Communication Compliance Kit: Training document of the Occupational Safety Engineer, Bureau of Labor Safety Division, Station #82, Augusta. Revised 8/91.

Pamphlets, Articles, and Fact Sheets

"Hazardous Incinerators?" Science News 143:21, p.334. May 22, 1993.

"Household Hazardous Substances/Household Hazardous Waste," Marquita Hill, Chemicals in the Environment Information Center, University of Maine, Orono. (information paper).

Maine Waste Management Agency Fact Sheets:

a. Household Batteries, January 1993
b. Household Hazardous Waste, January 1993
c. Waste Oil Recycling, January 1993
d. Waste Paint, January 1993

"Minimizing Household Hazardous Waste," Ginia Bellafante, Garbage Magazine, March/April 1990.

"The World Is Full of Toxic Waste. Your Home Shouldn't Be," Natural Resources Council of Maine. Augusta.

Instructional Resources

40 Low Waste/Low Risk Experiments for High School Chemistry
J. Weston Welch Publishers,
Portland, ME; 1994
Contact: David Dougin
ChemSafe Consulting, Inc.
P.O. Box 332
Mapleton, ME 04757
(207) 764-5387

This manual was developed to reduce both student exposure to hazardous chemicals and the quantity of hazardous waste generated in chemistry experiments. The scope of the experiments and quality of the outcomes are comparable to traditional methods. Non hazardous substitution and microscaling are utilized to achieve meaningful quantitative and qualitative results. The manual is designed to interface with existing textbooks. Student text $9.95, Teacher text $11.95.

Canadian Environmental Education Catalogue
The Pembina Institute of Appropriate Development
P.O. Box 7558
Drayton Valley, Alberta T0E 0M0
Canada
(403) 542-6272

This is a comprehensive catalog with 34 environmental topics. It covers books, videos, films, posters, games, music, magazines from the U.S. and Canada; short descriptions of each resource with notes on focus area and suggested uses, reading level, ordering information. Updated annually. $55 (plus $10 shipping to the U.S.), computer subscriptions available for $120.

Composting: Wastes to Resources
Leader's Guide to Community Action
Recycling: Mining Resources from Trash
Waste Management Fact Sheet Set
What About Waste
Contact: Resource Center-GP
Cornell University
7 Business and Technology Park
Ithaca, NY 14850
(607) 255-9946

Fact sheets on plastics, composting, incinerators, options for waste prevention. Order # 174WMSET, $10.25. *What About Waste* is a booklet describing waste issues. Order # 147WAW, $3.00. Recycling: Mining Resources from Trash includes 5 posters (aluminum, glass, paper, plastic and Watching Your Waste.) Order # 174RMT, $8.00. Leader's Guide order # 1595115, $2.85. Composting includes 2 posters: How Does Composting Work? and Best Compost. Order # 147CWRF, $8.00.

Conservation Foundation Publications and Film List
1717 Massachusetts Ave., NW
Washington, DC 20036

Write for catalog.

Earth to Kids, Consumer Reports TV (video)
Contact: Consumer Reports TV
256 Washington St.
Mt. Vernon, NY 10553
(914) 378-2000

This is an interesting video which compares the environmental impact of brand-name products. It gives students a very clear idea of what to look for in purchasing products, and helps them make decisions about what they might "need" or might be able to do without to help protect the environment.

Crafts from Trash
Wisconsin Dept. of Natural Resources; 1984
Contact: Wisconsin Dept. of Natural Resources
Bureau of Solid Waste Management, Bureau of Information and Education
Madison, WI 53703

E: The Environmental Magazine
Contact: Earth Action Network
Environmental Media
P.O. Box 1016
Chapel Hill, NC 27514
(800) 368-3382

E Magazine is an award-winning clearinghouse of environmental information and commentary. It offers teachers and students thorough and thoughtful articles and additional resources for more information. Bimonthly (8 issues) $14.94/year. Offered at 25% discount through Environmental Media catalog. Also available from E: The Environmental Magazine, P.O. Box 5098, Westport, CT 06881.

Ecol-O-Kids Catalog
3146 Shadow
Topeka, KS 66604
(800) 423-7202

Provider of books, videos, teaching materials covering Ecology (including waste issues), Environmental Classroom, Endangered Animals, Water, Rain Forest, Forest, Antarctica

The Environmental Shopper
Contact: Pennsylvania Resources Council
25 West 3rd Street
Media, PA 19063

This instructive booklet is a list of products that use recycled packaging, $2.00.

Environments and Ecology Catalog
Cornell University
Audiovisual Resource Center
8 Research Park
Ithaca, NY 14850
(607) 255-2080

Annotated list of films, filmstrips, tapes, and publications

Garbage: The Practical Journal for the Environment
Contact: Dovetail Publishers
The Blackborn Tavern
2 Main Street
Glouster, MA 01930
(508) 283-3200

Garbage contains informative articles which cover a variety of solid waste issues. The editorial position tends to emphasize technical solutions to environmental problems and minimizes the significance of some issues.

Hand Papermaking: Recycling Education at Its Best
(800) 277-1424

This is an article that appeared in Resource Recycling Magazine showing how children can make their own recycled paper. Includes a list of equipment suppliers and publishers. Call for a copy.

How to Make Treasures From Trash
by Artis Arleen Eckstein
Heathnide Press, Great Neck, NY
Contact: Heathnide Press, Inc.
Great Neck, NY 11021

BEST COPY AVAILABLE

Instructional Resources

How to Start a School Recycling Program
Council for Solid Waste Solutions
Suite 400
1275 K St., NW
Washington, DC 20005
(800) 2-HELP-90

Step-by-step plan to set up a school recycling program. Includes case studies.

IKANTU - I Can Too! (game)
by Deborah Boccanfuso; 1992
Darien, CT
(203) 847-4387

IKANTU is a card game developed by Deborah Boccanfuso, a teacher at a Darien, CT middle school. It is a fast-paced game based on recycling where players "recycle" brightly colored "recyclable item" cards to earn points. Grades 3 and up.

Keep It Green Game
Environmental Media
P.O. Box 1016
Chapel Hill, NC 27514
(800) 368-3382

Keep It Green is a cooperative learning game of environmental awareness for children and adults. Players attempt to reach Planet Earth while it is still green and living. Those who reach the planet first are encouraged to return to help others. Game $24.95, manual $5.95.

The Kid's Guide to Social Action
by Barbara Lewis; Free Spirit Publishing, Minneapolis; 1991
Contact: Free Spirit Publishing, Inc.
400 First Avenue North, Suite 616
Minneapolis, MN 55401
(612) 338-2068

The Kid's Guide to Social Action is subtitled "How to solve the social problems you choose - and turn creative thinking into positive action." It contains inspiring accounts of how kids and school classes have taken action steps to effect real change in their communities and beyond. The guide focuses on specific skills, many of which are briefly described in Pathways to a Sustainable Future - Letter writing, interviewing, media coverage, fundraising, campaigning changing laws, and more. This is a very effective book!

The Lorax (video)
Contact: Michigan Media
University of Michigan
400 Fourth St.
Ann Arbor, MI 48103-4816

Video for all ages. This is an animated Dr. Seuss film about the destruction of natural resources and resulting pollution. Available for rent.

Maine Waste Management Agency Resources
State House Station # 154
Augusta, ME 04333
(207) 287-5300 or (800) 662-4545

The MWMA office maintains a supply of up-to-date information sheets and background material available for citizens. Items recommended for classroom teacher use are listed here. New ones are being produced regularly. *Request a complete list of items available.*

Publications:

Model Graphics - reproducible clip art and posters

Municipal Recycling Programs in Maine - directory of local and regional recycling programs

Plastics Recycling Guide

Waste Management Services Directory - a directory of resources and services available for handling and marketing of recyclables

The Waste Watcher - MWMA Newsletter

Fact Sheets:

9 Steps of Office Paper Recycling
Buying Recycled Paper
Cloth vs. Disposable Diapers
Composting with Worms
Getting Your Recycling Message Out
Holiday Reduction & Recycling Tips
Household Batteries
Household Hazardous Waste
Paper vs. Plastic bags
Planning a Recycling Program
Plastic Recycling
Set Up a School Recycling Program
Waste Reduction Tips for Consumers
Why Recycle?

Other Handouts:

Basics of Household Separation
Buying Recycled Through Maine State Government
Diaper Brochure
Home Composting Brochure (Cooperative Extension)
Household Hazardous Waste
List of Resources (composting, recycling, etc.)

Videos:

Regional Waste Systems Proudly Presents

Produced by: Regional Waste Systems, Portland, ME. Spring 1992. Time: Approx. 10 min. An overview of RWS incinerator and recycling program.

Strength in numbers: Recycling in multi-family housing

Produced by: Association of New Jersey Environmental Commissions, Mendham, NJ. 1988. Time: Approx. 10 min. Step by step in how-to. Overview of setting up multi-family recycling programs. Discusses storage/locations. Concepts can be adapted for businesses.

The Choice is Yours

Time: 55 min. Jr/Sr High, College, Adult Education. This documentary traces the journey of recyclable materials through the recycling chain back to the consumer. Landfills are discussed. Packaging is examined. This documentary also goes international.

The Re-Team

Produced by: Hot Pepper Video. Time: Approx. 25 min. A fact-filled, riveting, live-action program featuring colorful cartoon characters & catchy tunes that children will love - Age 6-12. The Re-Team, a trio of environmental super heros battle the Garbage Monster and teach kids the fun way to reduce, reuse, & recycle.

The Resource Revolution

Produced by: The Council for Solid Waste Solutions. 1991. Time: 12 min. Discusses the revolution in plastics recycling and the role recycling plays in dealing with the garbage crisis. Designed for students (grades 7-12).

The Wiscasset Spring 1992 School Food Waste Recycling Project

Time: Approx. 15 min. Describes planning & implementation of a pilot project in Wiscasset school system; composting cafeteria food & paper waste. Includes education of students with hands-on demonstrations of three backyard composting units: wire compost bin, barrel composter, and 3-bin system. Produced by: University of Maine Cooperative Extension, Copyright. 1992.

Marz Barz, songs for kids of all ages (music cassette)
Bob Reid and Friendz, Blue Bear Records, 1989
Contact: Bob Reid
P.O. Box 505
Aptos, CA 95003
(408) 662-0164

Many engaging songs including "Garbage", "Do You Care About Earth?", "Habitat."

The Official Recycled Products Guide
American Recycling Market, Inc.
P.O. Box 577
Ogdensburg, NY 13669
(800) 267-0707

The guide is a directory of manufacturers and vendors of recycled products. It comes as a monthly newsletter or as an on-line database by subscription.

The Philadelphia Worm Co.
P.O. Box 9586
Philadelphia, PA 19124
(215) 744-2349

One source of red worms for worm composting projects.

The Plastics and the Environment Sourcebook
Polystyrene Packaging Council
1025 Connecticut Ave., NW, Suite 515
Washington, DC 20036
(202) 822-6424

The Plastics and the Environment Sourcebook contains a listing of plastics-related curricula and several classroom activities about the characteristics of plastics, their use, and plastic recycling.

Pollution: Problems and Solutions NatureScope Teacher's Guide
National Wildlife Federation
1400 16th Street, NW
Washington, DC 20077-9964

The NWF is a multi-issue environmental organization, publishes Ranger Rick Magazine for children, and Ranger Rick's NatureScope, an environmental activity series for teachers. The NatureScope issue on Pollution: Problems and Solutions addresses solid waste, air and water pollution, and offers suggestions for action steps.

Recycling: Games, Science Equipment, and Crafts From Recycled Materials
by Robin Smith; Houghton Mifflin, 1976

Recycling Information Kit
Consumer Information Center
P.O. Box 100
Pueblo, CO 31002

Ask for recycling information for children.

Recycling: Waste Into Wealth (video)
Bullfrog Films
Oley, PA 19547

Intermediate and Advanced. Includes steps for starting a recycling program.

The Rotten Truth (video)
Contact: The Rotten Truth
5959 Triumph St.
Commerce, CA 90040

Intermediate level. This video is an upbeat look at the trash problem. Produced by 3-2-1 Contact.

Seventh Generation Catalog
Contact: Seventh Generation, Inc.
Colchester, VT 05446
(800) 456-1177

Seventh Generation is a catalog retailer of "products for a healthy planet." Items include energy saving devices, products made from recycled materials, clothing made from organically grown cotton

Solid Thinking About Solid Waste (curriculum guide)
Kraft General Foods, 1992
Contact: Deborah Becker
Dept. of Environmental Policy, Kraft General Foods
Three Lakes Drive
Northfield, IL 60093

The *Solid Thinking* curriculum is an excellent resource for middle school classes. It involves a research-based approach with students doing important investigations. Highly recommended for groups who what to do a more thorough analysis of their waste disposal issues.

The Solid Waste Mess: What Should We Do About It?
North American Association for Environmental Education
P.O. Box 400
Troy, OH 45373
(513) 467-8753

NAAEE is an international membership organization committed to the professional development of environmental educators throughout the world. Among NAAEE publications is *The Solid Waste Mess: What Should We Do About It?* (Issue Book, $4.98, and Moderators Guide $2.00). These contain information about the solid waste issue and is designed for leaders to start a study circle. Other issues covered in the Environmental Forum series are Wetlands: Environment at Risk and Energy Options. Order from the Environmental Issues Forum at the address above.

Special Report: You Can Make a Difference (video)
National Wildlife Federation, Discovery Channel, 1990
Contact: National Wildlife Federation
1412 16th St., NW
Washington, DC 20036
(202) 797-6800

Good video presented by the National Wildlife Federation and the Discovery Channel showing how young people work with business leaders, elected officials, parents and teachers to cut waste, reduce the use of toxic chemicals, save energy and water, clean the air, protect endangered species and habitat.

The Stop Junk Mail Book
by Dorcas S. Miller; Georgetown Press, Georgetown, ME
Contact: Dorcas Miller
RR 2 Box 535
Augusta, ME 04330

This book contains many strategies for reducing unwanted mail; 32 pre-printed postcards to stop junk mail.

Too Much Trash? Computer Linked Research Program
National Geographic Kids Network
Contact: Karol Media
P.O. Box 7600
Wilkes-Barre, PA 18773
(717) 822-8899

The NGS Kids Network is a coordinated national research project which links a classroom to a regional research team and unit scientist through a computer network. The Too Much Trash? project has students inventory the school waste stream and provide data to the research team. Students analyze and compare data from other classes in the team, then receive a national profile using all the NGS teams' data. The teaching guide helps organize action projects for the school. A free preview copy is available. The kit costs $375 and there is an annual subscription fee for the research program. Grades 4-6.

Instructional Resources

Trash Conflicts: A Science and Social Studies Curriculum on the Ethics of Disposal
by Amy Ballin, Jeffrey Benson, and Lucille Burt; Educators for Social Responsibility, 1993
Contact: Educators for Social Responsibility
23 Barden St.
Cambridge, MA 02138
(800) 370-2515

Trash Conflicts promotes a deeper understanding of the impact of waste production and disposal. Through science-based experiments, research and analysis, role plays, and discussions students learn about the nature of garbage, disposal methods, consumer behavior, toxic waste, and the political process surrounding trash disposal. Grades 6-8.

Waste Watch Center Publications
Contact: Dana Duxbury and Associates
16 Haverhill St.
Andover, MA 01810
(508) 470-3044

Considered one of the leading sources of information about household hazardous waste management information in the country. Request publication list.

Woodsy's Wastewise (slide set)
Audiovisual Resource Center
8 Research Park
Cornell University
Ithaca, NY 14850
(607) 255-2080

This is a slide set and activity booklet that features Woodsy Owl and shows kids how to reduce waste.

Worms Eat My Garbage
by Mary Appelhof
Flower Press; Kalamazoo Michigan; 1982.

Excellent basic book on composting with worms and constructing worm bins.

Trade Books for Younger Students

50 Simple things Kids Can Do to Save the Earth
EarthWorks Group; Andrews and McMeel Publishers, Kansas City; 1990
Contact: Andrews and McMeel Publishers
4900 Main St.
Kansas City, MO 64112
Explains how specific things in a child's environment are connected to the rest of the world, how using them affects the planet, and how the individual can develop habits and projects that are environmentally sound.

Earth Book for Kids
by Linda Schwartz
The Learning Works, Santa Barbara, CA; 1990
Contact: The Learning Works, Inc.
P.O. Box 6187
Santa Barbara, CA 93160
Offers children, parents, teachers a wide variety of ways to learn about the environment while having fun.. Contains creative ideas for activities for kids to learn about the environment and care for the earth. Sections on energy resources and recycling, air land and water, habitats, ways to make every day Earth Day.

Going Green. A Kid's Handbook to Saving the Planet
by John Elkington, Julia Hailes, Douglas Hill, Joel Makower
Puffin Books, NY; 1990
Contact: Viking Penguin, Penguin Books
375 Hudson St.
New York, NY 10014
This is an engaging, empowering book for students offering information about environmental issues (global warming, ozone, air & water pollution, trash), "green" audits, and things you can do.

The Green Lifestyle Handbook
edited by Jeremy Rifkin; Henry Holt; 1990

The Lorax
by Dr. Seuss; Random House, NY; 1971
All ages. The Lorax is a classic of children's environmental literature. This is an allegory of environmental destruction by industrialization which generates sympathy for all life. Stimulates thought and discussion about human behavior and motivations .

Mr. Rumples Recycles
by Barbara Anne Coltharpe
Hyacinth House Publishing; 1989

My First Green Book
by Angely Wilkes; Knopf; 1991
ISBN 0-679-81780-8; grades 2-5. This book helps to explain to young children what environmental problems are and what they can do to help. Topics include recycling, water and air pollution, and acid rain. This hands-on activity book is for children who want to be part of the solution rather than part of the problem. Photographs. Listed as an Outstanding Science Book for Young Children in 1991 (Young Children Magazine, May, 1992.)

Oh!ZONE
Contact: Upper Great Lakes Educational Technologies, Inc.
Marquette Institute for the Environment
420 East Hewitt Ave.
Marquette, MI 49855
(906) 226-9500
Oh!ZONE is a nationally distributed quarterly journal of environmental news, are, and opinion published by a committee of students (intermediate, high school, college.) Membership in Project Oh!ZONE ($12.95/year, schools with 1 to 10 additional names to the same address for $7.95, $4.95 each for the 11th on) receive the magazine and Member Newsletter (every 6-8 weeks). Articles, stories, drawings, and photos are accepted for the publication. Items not accepted for Oh!ZONE may be published in the Member Newsletter. The Member Newsletter is for stories about the things students are doing in their schools and communities.

Save Our Planet - 750 Everyday Ways You Can Help Clean Up the Earth
by Diane MacEachern; Dell Publishing, NY; 1990
Contact: Dell Publishing Inc.
666 Fifth Ave.
New York, NY 10103

Who Really Killed Cock Robin?
by Jean George; Harper Collins; 1971
This is an environmental mystery where kids investigate the source of pollution which is killing the wildlife. Stimulating and empowering.

The World That Jack Built
by Ruth Brown; Dutton; 1991
ISBN 0-525-4435-4; grades preK-1. A simple, highly dramatic text with illustrations. This story shows how human technology affects the environment, and it empowers young people with the feeling of "I can make it better." This book should interest any elementary school child. Listed as an Outstanding Science Book for Young Children in 1991 (Young Children Magazine, May, 1992.)

BEST COPY AVAILABLE

Organizations & Agencies

ADVO Systems, Inc.
List Services Manager
239 West Service Road
Hartford, CT 06120-1280
ADVO maintains address lists which are sold to direct mailing operations. To reduce "junk mail" contact ADVO and ask to have your name (and any variations) removed from the list. See also Mail Preference Service.

The Aluminum Association
900 19th Street, NW
Washington, DC 20006
(202) 862-5163
Provides public information and Packaging Programs. Publications include Fact Sheets on Aluminum (Aluminum Recycling, Aluminum Food and Beverage Cans, Aluminum Foil and Packaging). Video available, Aluminum Recycling: Your Next Assignment, free.

American Paper Institute
Paper Recycling Committee
260 Madison Avenue
New York, NY 10016
(212) 340-0600
Publications include free paper recycling pamphlets and brochures including: 12 Facts About Waste Paper Recycling, How to Recycle Waste paper and Paper Recycling and It's Role in Solid Waste Management. Also posters, and free loan video on paper recycling.

Center for Hazardous Materials Research
University of Pittsburgh
320 William Pitt Way
Pittsburgh, PA 15238
(412) 826-5320
The Center develops educational materials for the management of household hazardous waste including recipes for alternative cleaning products.

Chemicals in the Environment Information Office
University of Maine
105 Jenness Hall
Orono, ME 04469
(207) 581-2301
Dr. Marquita Hill develops information and teaching materials promoting Pollution Prevention.

The Chewonki Foundation
RR 2 Box 1200
Wiscasset, ME 04578
(207) 882-7323
Chewonki offers environmental education programs for schools, Maine Coast Semester (11th grade semester focusing on environmental issues and natural science), wilderness expeditions, summer camp, teacher resources.

Children's Alliance for the Protection of the Environment
Contact: CAPE
P.O. Box 307
Austin, TX 78767
(512) 476-2273
Schools, clubs, and any group of 20 or more with an adult sponsor can join CAPE as a chapter (annual membership fee $25). Chapters are encouraged to work on local environmental projects and may join cooperative projects on an international level. The CAPE Program Guide (leader's manual) is available, CAPE newspaper, "Many Hands."

Citizen's Clearinghouse for Hazardous Waste
P.O. Box 926
Arlington, VA 22216
(703) 276-7070
Focus on grassroots organizing, public awareness, and legislative involvement; publications include Household Hazardous Waste Fact Pack ($2.00), Recycling: The Answer to Our Garbage Problems ($8.98).

Concern About Kids' Environment (CAKE)
Contact: CAKE
29 Pine St.
Freeport, ME 04032
(207) 865-6263
CAKE is an environmental action network for young people. It was founded by children for children and allows them to express their feelings about the environment as well as to act creatively to affect their world in positive ways. Can provide support for other action-oriented children's organizations.

The Conservation and Renewable Energy Inquiry Referral Service
P.O. Box 8900
Silver Spring, MD 20907
Offers recycling and conservation information for school children, write for information.

Environmental Action Coalition
625 Broadway
New York, NY 10012
(212) 677-1601
The EAC provides information on a variety of issues including waste batteries, battery legislation, and pilot collection programs. They respond to requests for specific information on environmental effects of batteries, source reduction, current legislation and market conditions.

Environmental Defense Fund
257 Park Avenue South
New York, NY 10010
(800) CALL-EDF
The active EDF campaign "If You're Not Recycling, You're Throwing It All Away" provides information about recycling for citizens. EDF focuses on legislative efforts in many environmental areas.

Environmental Hazards Management Institute
P.O. Box 932
Durham, NH 03824
(603) 868-1496
The Institute develops educational materials for the management of household hazardous waste including recipes for alternative cleaning products.

Flinn Scientific
P.O. Box 219
131 Flinn Street
Batavia, IL 60510-0219
(321) 879-6900
Flinn has developed MSDS (material safety data sheets for science teachers. Call for information.

Glass Packaging Institute
1133 20th Street, NW, Suite 321
Washington, DC 20036
(202) 887-4850
Publications include Glass Recycling: Why? How? and The Great Glass Caper, a teaching kit designed to teach about benefits of recycling glass containers, newspapers and aluminum cans.

Incinerators - Maine's major Incinerators

Maine Energy Recovery Co. (MERC), Biddeford
(207) 282-4127
Mid Maine Waste Action Corp., Auburn
(207) 782-7716
Penobscot Energy Recovery Co. (PERC), Orrington
(800) 698-0859
Regional Waste Systems (RWS), Portland
(207) 773-6465

Kids Against Pollution
Contact: Tenakill School
275 High Street
Closter, NJ 07624
A network of children's groups active in environmental clean-up.

Kids for Saving Earth
Contact: Tessa Hill
P.O. Box 47247
Plymouth, MN 55447
(612) 525-0002
KSE is an organization for helping kids everywhere find ways to protect the environment. Membership (no cost, tax deductible donations accepted) receive newspaper of ideas and activities from KSE members worldwide. School groups (preK-HS) are encouraged to form a KSE Club. To register, the group needs an adult advisor and a completed registration form (available from KSE.

Landfills - Maine's Major Landfills

Crossroads Landfill, Norridgewock
(800) 562-7779
Hatch Hill Landfill, Augusta
(207) 626-2365
Sawyer Environmental Services, Bangor
(207) 947-4997
Tri-Community Recycling and Sanitary Landfill, Caribou
(207) 473-7840

League of Women Voters
1730 M Street, NW
Washington, DC 20036
The League of Women Voters is very active in recycling and waste issues for communities. Local chapters also have information.

Mail Preference Service
Direct Marketing Association
P.O. Box 9008
Farmingdale, NY 11735
The Mail Preference Service maintains address lists which are sold to direct mailing operations. To reduce "junk mail" contact them and ask to have your name (and any variations) removed from the list. See also ADVO Systems.

Maine Audubon Society
Gilsland Farm, 118 U.S. Route 1
P.O. Box 6009
Falmouth, ME 04105
(207) 781-2330
The Teachers' Resource Center at Maine Audubon offers information and curriculum materials, workshops, and teacher support. MAS also offers school programs and seasonal walks at several sanctuaries, field trips and world tours, and is an advocate for habitats and wildlife issues.

Maine Dept. of Education
Division of Curriculum
State House Station #23
Augusta, ME 04333
(207) 287-5925
The Division of Curriculum oversees the implementation of the Common Core of Learning and consults with school districts.

Maine Environmental Education Assn.
P.O. Box 9
Wiscasset, ME 04578
(207) 882-7323
MEEA is a statewide membership organization serving the environmental educators of Maine with a quarterly newsletter and an annual conference. It is a state affiliate of the New England Environmental Education Assn.

Maine Dept. of Environmental Protection
Bureau of Hazardous Materials & Solid Waste Control
State House Station 17
Augusta, ME 04333
(207) 287-2651 or (800) 452-1942
Regulates animal waste disposal and recycling, composting, hazardous wastes including small quantity generators, landfills (inspection and regulation), recycling facility licensing, incinerators. Promotes toxics use reduction. Regional Offices are located in Bangor, Portland, and Presque Isle.

Maine Math and Science Alliance (MMSA)
P.O. Box 5359
Augusta, ME 04332
(207) 287-5881
The MMSA administers the National Science Foundation grant for the Statewide Systemic Initiative (SSI) and the Beacon Schools project.

Maine Resource Recovery Assn.
Local Government Center
Community Drive
Augusta, ME 04330
(207) 623-8428
Promotes professional solid waste management in Maine and works to further the development of recycling and resource recovery in a cost-effective, environmentally sound manner.

Maine Waste Management Agency
State House Station # 154
Augusta, ME 04333
(207) 287-5300 or (800) 662-4545
MWMA is responsible for administering the state's waste management and recycling programs. The agency includes the Office of Planning, Siting and Disposal Operations, and the Office of Waste Reduction and Recycling. The main functions of each office are listed below.

Office of Waste Reduction and Recycling is the technical assistance arm of the MWMA. It provides services to municipalities, businesses, and individuals.

- *Technical Assistance.* Office staff provide technical assistance to communities, businesses, and institutions in setting up waste reduction, recycling, and composting programs.
- *Public Education.* The office is responsible for promoting and providing public education in support of the state's waste reduction and recycling goals. Educational material is available through the office.
- *Financial Assistance.* Financial Assistance programs include: Capital Investment grants for recycling equipment for municipalities, recycling feasibility studies, and investment tax credits.

230
BEST COPY AVAILABLE

Organizations & Agencies

- *Market Information.* The Waste Management Services Directory provides information about markets and resources to provide assistance with marketing recyclables. In addition, the office has funded a statewide cooperative marketing program through the Maine Resources Recovery Association and is working to develop new markets for recycled materials.
- *Clearinghouse.* The office maintains a large file of information on waste reduction, recycling, composting, and other technical aspects of solid waste management. In addition, the office has produced a comprehensive guide for towns titled *Recycling: A Guide for Maine Towns*, along with many other publications included in this listing of Resouces and in the Waste Management Services Directory.
- *Waste Reduction.* The office coordinates programs which can assist municipalities and businesses reduce their waste stream. The WasteCap program is a "business helping business" program designed to provide technical assistance on waste reduction and recycling in manufacturing processes. The Model Business/Community Program is geared for smaller retail and service businesses. Criteria have been developed, which when met, designates the individual business as a "model" in its trade. The office also provides assistance to businesses to implement office paper and corrugated cardboard recycling programs.

Office of Siting and Disposal Operations is available to assist municipalities in evaluating solid waste disposal options and problems. In addition, the office will develop fact sheets, an information exchange newsletter, and training programs for solid waste handling and disposal, including bulky waste management.

McDonald's Educational Resource Center
McDonald's Corporation
Box 8002, Dept. L-90
St. Charles, IL 60174
Publication available: Environmental Action Pack," for grades 3-6.

McDonald's of Maine Operators Assn.
Sue McClain
(207) 773-7233
The association is administered by the Arnold Public Relations Agency and has provided funding for environmental projects. Funding may also be provided by your local McDonald's restaurant.

National Audubon Society
700 Broadway
New York, NY 10013
(212) 979-3000
(800) 274-4201 for membership information
National Audubon is a membership organization addressing environmental concerns. They publish Audubon magazine 6 times/year and develop community information and educational materials.

National Center for Resource Recovery
1211 Connecticut Avenue, NW
Washington, DC 20036
Publications include Waste Not (a primer on resource recovery, 15¢), Glossary (definitions of waste management and resource recovery subjects, 50¢), Fact Sheets (set of 16 fact sheets on various solid waste management subjects $1.50), reprints of NCRR Bulletin (municipal Solid Waste, its volume, composition and value and others, 50¢ each).

National Consortium for Environmental Education and Training
University of Michigan
School of Natural Resources & Environment
Dana Building 430 E. University
Ann Arbor, MI 48109-1115
NCEET provides many teacher materials for planning and organizing environmental education activities. (Toolbox: Getting Started, $9.95, National Survey of EE teacher Education, $6.95.)

National Science Teachers Association
1742 Connecticut Avenue, NW
Washington, DC 20009
(202) 328-5800
NSTA is a national membership organization for science teachers. They are developing the Project on Scope, Sequence, and Coordination, an effort to redesign science education in American schools.

National Solid Wastes Management Association
1730 Rhode Island Avenue, NW, Suite 100
Washington, DC 20036
(202) 659-4613
Offers several colorful pamphlets and fact sheets on solid waste topics.

National Toxics Campaign
29 Temple Place, 5th Floor
Boston, MA 02111
(617) 482-1477
Publication list and summary of activities available on request.

National Wildlife Federation
1400 16th Street, NW
Washington, DC 20077-9964
The NWF is a multi-issue environmental organization, publishes Ranger Rick Magazine for children, and Ranger Rick's NatureScope, an environmental activity series for teachers. The NatureScope issue on Pollution: Problems and Solutions addresses solid waste, air and water pollution, and offers suggestions for action steps.

The Natural Connection
P.O. Box 8233
North Brattleboro, VT 05304
(802) 365-7188
Provide a directory of manufacturers of eco-friendly products.

Natural Resources Council of Maine
271 State St.
Augusta, ME 04330
(207) 622-3101
NRCM is a non-profit environmental advocacy group that lobbies for recycling and source reduction issues, participates in administrative rule making and hearings, and adopts positions on various recycling, household hazardous waste and waste management issues.

North American Association for Environmental Education
P.O. Box 400
Troy, OH 45373
(513) 467-8753
NAAEE is an international membership organization committed to the professional development of environmental educators throughout the world. Among NAAEE publications is *The Solid Waste Mess: What Should We Do About It?* (Issue Book, $4.98, and Moderators Guide $2.00). These contain information about the solid waste issue and is designed for leaders to start a study circle. Other issues covered in the Environmental Forum series are Wetlands: Environment at Risk

and Energy Options. Order from the Environmental Issues Forum at the address above.

Northeast Recycling Council
139 Main St., Suite 401
Brattleboro, VT 05301
(802) 254-5870

NERC is a non-profit, non-partisan agency established by the ten northeastern states. Its primary focus is the development of regionally consistent and compatible policies and programs that are intended to stimulate markets for recyclable materials.

Plastic Loose-Fill Producers Council
(800) 828-2214

The Council lists the locations and phone numbers of local collection points of loose-fill packing material (foam "peanuts"). The sites are usually businesses which do a lot of shipping and mailing like Mail Boxes, Etc.

Plastics Again
24 Jytek Park
Leominster, MA 01453

Ask for information on starting a school plastics recycling program.

Polystyrene Packaging Council
1025 Connecticut Ave., NW
Suite 515
Washington, DC 20036
(202) 822-6424

The Council offers a free information package containing the location of the nearest polystyrene recycling centers and the types of materials they accept.

Recycled Products Information Clearinghouse
5525 Hempstead Way
Springfield, VA 22151
(703) 941-4452

CERMA provides information about recycled products, guidelines, "buy recycled" programs, and recycled product specifications.

Reynolds Aluminum Recycling Co.
17 Murphy Rd.
Hartford, CT 06114
(203) 278-6136

Offers a free comic book on can recycling and a color-your-own poster on recycling.

Stop Junk Mail Assn.
Michael Esh
3020 Bridgeway, Suite 150
Sausalito, CA 94965
(800) 827-5549

The SJMA offers a kit ($17.50) to help stop your junk mail. When you order the kit, the SJMA has your name(s) removed from the national direct mail lists and sends you materials to help you notify all other sources of junk mail. It also offers suggestions to stop delivery of junk mail by the post office. The SJMA is involved with lobbying in Washington, DC to reform post office practices of selling addresses for direct mail.

University of Maine Cooperative Extension - County Offices for Maine

Aroostook County Cooperative Extension
Nancy Bradford-Sisson
13 Hall St.
Fort Kent, ME 04743
(207) 834-3905 or (800) 287-1421
Houlton Office
Bernadette Farrar
P.O. Box 8
Houlton, ME 04730
(207) 532-6548 or (800) 287-1469

Cumberland County Cooperative Extension
Doug Babkirk
96 Falmouth St.
Portland, ME 04103
(207) 780-4205 or(800) 287-1471

Franklin County Cooperative Extension
Ray Corey
78 Main St.
Farmington, ME 04938
(207) 778-4650 or (800) 287-1478

Hancock County Cooperative Extension
Marjorie Hundhammer
RR 5
Ellsworth, ME 04605
(207) 667-8212 or (800) 287-1479

Kennebec County Cooperative Extension
Karen Hatch Gagne
290 Eastern Ave.
Augusta, ME 04330
(207) 622-7546 or (800) 287-1481

Knox/Lincoln County Cooperative Extension
Les Hyde
375 Main St.
Rockland, ME 04841
(207) 594-2104 or (800) 244-2104

Oxford County Cooperative Extension
Susan Jennings
RR 2 Box 1735
South Paris, ME 04281
(207) 743-6329 or (800) 287-1482

Piscataquis County Cooperative Extension
Jane Conroy
Court House Complex
Dover-Foxcroft, ME 04426
(207) 564-3301 or (800) 287-1491

Penobscot County Cooperative Extension
Beth Parks
Court House Annex
Bangor, ME 04401
(207) 942-7396 or (800) 287-1485

Somerset County Cooperative Extension
Bruce Oglivie
P.O. Box 98
Skowhegan, ME 04976
(207) 474-9622 or (800) 287-1495

Twin County (Androscoggin/Sagadahoc) Cooperative Extension
Bob Elliot
133 Western Ave.
Auburn, ME 04210
(207) 786-0376 or (800) 287-1458

Waldo County Cooperative Extension
Jane Haskall Cowles
RR 2 Box 641
Belfast, ME 04915
(207) 342-5917 or (800) 287-1426

BEST COPY AVAILABLE

Organizations & Agencies

Washington County Cooperative Extension
Durwood Gray
11 Water St.
Machias, ME 04654
(207) 255-3345 or (800) 287-1542

York County Cooperative Extension
Leanna Preston
P.O. Box 347
Alfred, ME 04002
(207) 324-2814 or (800) 287-1535

U.S. Environmental Protection Agency
Office of Solid Waste Management
401 M St., SW
Washington, DC 20460
(202) 382-4627 / (800) 424-9346

Region 1 Office
JFK Federal Building
Boston, MA 02203
(617) 573-9670

Offers a combination of technical and general information. A Catalog of Hazardous and Solid Waste Publications, free on request.

Waste Watch Center
Contact: Dana Duxbury and Associates
16 Haverhill St.
Andover, MA 01810
(508) 470-3044

Considered one of the leading sources of information about household hazardous waste management information in the country. Request publication list.

World Watch Institute
1776 Massachusetts Ave., NW
Washington, DC 20036
(202) 452-1999

World Watch tracks key indicators of the earth's well being by monitoring global changes in climate, forest cover, population, poverty, food production, water resources, biological diversity, and other major trends. World Watch Papers are published 6/year, each focuses on a particular environmental issue. "Discarding the Throwaway Society" World Watch Paper 101, by John E. Young, January, 1991.

California Compendium for Integrated Waste Management:

Reviews of outstanding curriculum materials from the Compendium

Introduction

Over the years, educators have assembled many activity guides and curricula for teaching about solid waste. In the absence of a state supported curriculum guide, Maine teachers have used a variety of materials - many of them with good success. Many of the guides currently available have excellent information and activities, and these guides can supplement the material in *Pathways to a Sustainable Future.*

The following listing is taken from the *Compendium for Integrated Waste Management*, a cooperative presentation of the California Department of Education, the California Integrated Waste management Board, and the California Department of Toxic Substance Control. The *Compendium* is the result of an extensive nationwide search for K-12 teaching materials on solid and hazardous waste. The curricula were evaluated by environmental educators, and those receiving a specific minimum grade were included in the *Compendium.* Others that were evaluated but which did not receive the minimum grade, were listen in an appendix. While there are surely some curricula that were not evaluated, and some have been published since the project was completed, the following summaries should be helpful for those teachers who are looking for additional materials to supplement the *Pathways* guide.

This listing includes all the publications that were included in the *Compendium,* along with the addresses and availability information, and the short descriptions from the *Compendium.* At the end of each entry is the "report card" which rates the material in six categories

General Content
Presentation
Pedagogy
Teacher Usability
Solid Waste
Hazardous Waste

The *Compendium* is divided into four grade categories (K-3, 4-6, 7-9, and 10-12) and curricula that cover more than one of the levels was evaluated separately for each. If a publication did not receive the minimum rating at a particular grade level, it was not included at that level (this is indicated as NR "not rated" in the "report card" listing here). In addition, a sample of one complete two-page entry from the *Compendium* follows the listing. This sample includes all of the comments and sample pages of the Waste Away curriculum published by the Vermont Institute of Natural Science.

This information is included in *Pathways to a Sustainable Future* with permission of the California agencies involved. We extend our gratitude to them. Copies of the *Compendium* are available for $4.50 by writing:

California Integrated Waste Management Board
Schools Section
8800 Cal Center Drive
Sacramento, CA 95826

The *Compendium* would make an excellent reference for any school looking for outstanding educational materials on solid or hazardous waste for any grade, K-12.

California Compendium for Integrated Waste Management

Summaries from the California *Compendium for Integrated Waste Management*

Waste Is a Terrible Thing to Waste
Grades K-6
Exegetics Interpretive and Educational Services
P.O. Box 191895
Sacramento, CA 95819-7895
(916) 381-7795
$35 plus tax

A collection of classroom activities for grades K-6, ranging from simple worksheets to difficult socio-dramas. This collection was written at the request of the Sacramento County, California, Solid Waste Management Division. 118 pages, 1991.

Report Card	K-3	4-6
General Content	B	B-
Presentation	B-	B
Pedagogy	B-	B-
Teacher Usability	B	B-
Solid Waste	C+	C+

Closing the Loop
Integrated Waste Management Activities for the School and Home
Grades K-12
The Institute for Environmental Education
18554 Haskins Road
Chagrin Falls, OH 44023-1823
(216) 543-7303
$32 for K-12
$28 for K-8
$26 for 9-12

A collection of activities grouped under three thematic sections: Everything Ends Up Somewhere, We Have Options and We Make Choices, and Everything Is Connected. Activities are intended to be hands-on problem centered, practical, and adaptable across grade levels and subjects. 1991.

Report Card	K-3	4-6	7-9	10-12
General Content	B	A+	A	A-
Presentation	B-	A+	B+	B
Pedagogy	B-	A+	A-	B
Teacher Usability	B	A	A	B+
Solid Waste	B-	A+	B+	A-
Hazardous Waste	C+	A	B+	B-

RAYS
"Recycle and You Save"
Grades K-6
San Diego County
Division of Solid Waste
5555 Overland Avenue
Mail Stop 0383
San Diego, CA 92123
(619) 974-2648
$15

A collection of activities correlated to the California State Frameworks for Science, Social Studies, mathematics, Language Arts, and Health. Designed to be easily integrated into daily teaching plans. Divided into grade level sections of K-2, 3-4, and 5-6. 71 pages, plus appendices, 1991.

Report Card	K-3	4-6
General Content	B-	B
Presentation	C+	B-
Pedagogy	C+	B
Teacher Usability	B	B+
Solid Waste	C-	C+

Super Saver Investigators
Grades K-6
Ohio Dept. of Natural Resources
Division of Litter Prevention and Recycling
Educational Specialists: SSI
Fountain Square, Building F-2
Columbus, OH 43224
(614) 265-6333
$25 check or money order, single orders only

An elementary, interdisciplinary, environmental studies activity guidebook about solid waste and natural resources that contains many hands-on, skill enhancing activities. The ideas for these activities were generated at a week-long workshop by a group of Ohio elementary teachers actively involved in environmental studies education. 384 pages, 1990.

Report Card	K-3	4-6
General Content	B-	B-
Presentation	C	C+
Pedagogy	C-	B-
Teacher Usability	B-	B
Solid Waste	C	B-
Hazardous Waste	NR	C+

The No Waste Anthology
Grades K-12
California Dept. of Toxic Substances Control
P.O. Box 942732
Sacramento, CA 94234-7320
(916) 322-0476
Free

A compilation of interdisciplinary, action-oriented, cooperative problem solving activities focusing on pollution prevention. Divided into three sections: Natural Resources and Pollution, Solid Waste, and Hazardous Waste. 320 pages, 1991.

Report Card	K-3	4-6	7-9	10-12
General Content	NR	A	B+	B+
Presentation	NR	A	A-	B
Pedagogy	NR	A	B+	B-
Teacher Usability	NR	A	A+	A-
Solid Waste	NR	A-	A-	B-
Hazardous Waste	NR	A	A+	B

A-Way with Waste (3rd Edition)
Grades K-12
Washington State Dept. of Ecology
3190 160th Avenue, SE
Bellevue, WA 98008-5452
Attn.: Jan Lingenfelter
$28.50

This curriculum is written and organized to present integrated waste management concepts affecting land, air, and water in the ecosystem. The activities are designed to promote

BEST COPY AVAILABLE

awareness, attitudes, and actions to solve waste management problems at home, in school, and in the community. 570 pages, 1990 (an updated version set for release in Sept. 1993).

Report Card	K-3	4-6	7-9	10-12
General Content	NR	A	A+	B+
Presentation	NR	A	B+	B-
Pedagogy	NR	A	A-	B
Teacher Usability	NR	A	A+	B+
Solid Waste	NR	A	A	B-
Hazardous Waste	NR	A-	A	B

Think Earth!
Environmental Education Program
Grades 4-6
Education Development Specialists
5505 East Carson St., Suite 250
Lakewood, CA 90713-3093
(310) 420-6814 Ann Cratton
Call for cost information

Three units that are interrelated and sequential, including a 27 minute video and individual grade packets containing teacher guides, blackline masters, and posters. 1993.

Report Card	4-6
General Content	A+
Presentation	A
Pedagogy	A
Teacher Usability	A
Solid Waste	A-

Waste Away
Upper elementary and Junior High
Vermont Institute of Natural Sciences
P.O. Box 86
Woodstock, VT 05091
(802) 457-2779
$18.95 plus $3 shipping/handling

Waste Away is designed to educate upper elementary and junior high school students who will, in turn, educate their schoolmates, families and community about solid waste issues. May be easily adapted to a variety of grade levels. 120 pages, 1989.

Report Card	4-6	7-9
General Content	A+	NR
Presentation	A	NR
Pedagogy	A	NR
Teacher Usability	A-	NR
Solid Waste	A-	NR

Teacher's Resource Guide for Solid Waste and Recycling Education
Grades K-12
Association of Vermont Recyclers
P.O. Box 1244
Montpelier, VT 05601
(802) 229-1833 Ivy Zeller
$45

This guide is designed to help Vermont teachers integrate solid waste and recycling education into their existing schedules and required courses. It is divided into grade level sections (K-3, 4-6, 7-8, 9-12), and includes large information and resources sections. 1989.

Report Card	K-3	4-6	7-9	10-12
General Content	NR	A	A	NR
Presentation	NR	A-	B	NR
Pedagogy	NR	A-	B	NR
Teacher Usability	NR	A+	A	NR
Solid Waste	NR	A-	B+	NR

Mobius® Curriculum
Understanding the Waste Cycle
Grades 4-6
Browning-Ferris Industries
P.O. Box 3151
Houston, TX 77253
Attn.: Tish Penn
1-800-BFI-8100
Free to teachers

This curriculum focuses on the "3Rs" through the subjects of science, mathematics and social studies. It can be used as part of your teaching plan or taught as a separate course. The worksheet packet at the back of the book offers a collection of exercises with varying degrees of difficulty for extra credit or extension activities. 121 pages plus handouts, 1992.

Report Card	4-6
General Content	A
Presentation	A-
Pedagogy	B+
Teacher Usability	A
Solid Waste	A-

Solid Waste Activity Packet for Teachers
Developed by:
Illinois Dept. of Energy and Natural Resources
Grades 3-5
Available through:
ERIC Clearinghouse for Science, Mathematics, and Environmental Education
The Ohio State University
1200 Chambers Road, Third Floor
Columbus, OH 43212
(614) 292-6171
Call for ordering information.

A compilation of materials adapted from other states on solid waste management education. Divided into seven sections: Introductory Materials, Reducing, Reusing, Recycling, Landfilling, Incineration, and Teacher Resources. 100 pages, 1990.

Report Card	4-6
General Content	A-
Presentation	B+
Pedagogy	B+
Teacher Usability	A
Solid Waste	B

California Compendium for Integrated Waste Management

Household Toxics
Grades 5-6
Solid Waste Services of the Municipality of Anchorage
P.O. Box 196650
Anchorage, AK 99519-6650
(907) 561-1906 Bill Kryger
$25 plus shipping.

A science-based curriculum specifically written for Anchorage. Intended to educate students on the everyday use of hazardous products in the home and the consequences of improper disposal. 1989.

Report Card	4-6
General Content	B
Presentation	B
Pedagogy	B+
Teacher Usability	B+
Hazardous Waste	B+

Teaching Toxics
Creating Solutions to Household Pollution
Grades K-12
The Association of Vermont Recyclers
P.O. Box 1244
Montpelier, VT 05601
(802) 229-1833 Ivy Zeller
$25.

A collection of activities which enable students to become aware of the environmental and health impacts of household hazardous wastes. Designed for Vermont teachers, it consists of four grade-level activity sections (K-3, 4-6, 7-8, 912), an information section and a resource section. 104 pages, 1992.

Report Card	K-3	4-6	7-9	10-12
General Content	NR	B+	B+	B-
Presentation	NR	B	B+	C+
Pedagogy	NR	B	B	C-
Teacher Usability	NR	A	A	B
Hazardous Waste	NR	B	A-	B-

Florida 4Rs Project
Preschool-12
Florida Dept. of Education
Educational Materials
Collins Building Room B1
Tallahassee, FL 32399-0400
(904) 487-7900 Melvyn Lord
$4.50

An anthology-type curriculum divided into four grade level packages (pre K-3, 4-5, 6-8, 9-12). Each package contains a Florida-specific general introduction, a set of individual lessons and blackline masters, and other student learning materials. 1990.

Report Card	K-3	4-6	7-9	10-12
General Content	NR	B	NR	B+
Presentation	NR	B+	NR	B
Pedagogy	NR	B	NR	B+
Teacher Usability	NR	A-	NR	A-
Solid Waste	NR	C+	NR	B

Garbage Reincarnation
Grades K-6
Sonoma County Community Recycling
P.O. Box 1375
Santa Rosa, CA 95402
(707) 584-8666 Linda Christopher
Call for cost information.

This Instructional Aids Packet is divided into four sections related to materials conservation and solid waste management. The four sections are: Solid Waste, Everything Goes Somewhere, Recycling in the Classroom and the Home, and Community Involvement. 51 pages. Updated version released in December 1993.

Report Card	K-3	4-6
General Content	NR	A-
Presentation	NR	B
Pedagogy	NR	B+
Teacher Usability	NR	B
Solid Waste	NR	C+

CHEM
Chemicals, Health, Environment, and Me
Grades 5-6
SEPUP (Science Education for Public Understanding Program)
Lawrence Hall of Science,
U.C. Berkeley
1 Centennial Drive
Berkeley, CA 94720
(510) 642-8718
$125 (Materials for 160 students).

Ten chemistry-based units utilizing commonly available household and classroom supplies, with the emphasis on direct experience by the learner. Includes teachers' guide with blackline masters, and a complete materials and equipment kit. 129 pages, 1993.

Report Card	4-6
General Content	B+
Presentation	B
Pedagogy	B-
Teacher Usability	A-
Hazardous Waste	C

Trash Today, Treasure Tomorrow
Grades K-6
Developed by: University of New Hampshire Cooperative Extension
Distributed by:
Governor's Recycling Program
Office of State Planning
2 1/2 Beacon Street
Concord, NH 03301
(603) 271-2155
$12.50

A collection of activities adapted from existing sources. Divided into five sections: Kindergarten Readiness, 1-2, 3-4, 5-6, and General Information. 1989.

Report Card	K-3	4-6
General Content	NR	B
Presentation	NR	C+
Pedagogy	NR	B
Teacher Usability	NR	B-
Solid Waste	NR	B-

Household Toxics
Grades 4-6
San Diego Regional Household Hazardous Materials Program
P.O. Box 8526
San Diego, CA 92186-5261
(619) 338-2175
$15.

Promotes the safe use, storage, and disposal of household toxics, and the use of safer alternatives. Materials include a video, lesson plans, teachers' guide, and reference materials. Some materials available in Spanish. 141 pages, 1988.

Report Card	4-6
General Content	C+
Presentation	C
Pedagogy	C-
Teacher Usability	B
Solid Waste	B-

Toxics In My Home? You Bet!
Grades 4-6
Developed by: Golden Empire Health Planning Center
Distributed by:
Local Government Commission
909 12th Street, Suite 305
Sacramento, CA 95814
(916) 448-1198
$12, or $16 with binder.

Consists of a one-week course of study designed to educate students about toxic substances commonly found in the home. Lessons may also be used individually. Materials available in Spanish. 50 pages plus appendices, 1984.

Report Card	4-6
General Content	B
Presentation	B-
Pedagogy	C
Teacher Usability	B-
Hazardous Waste	B-

Bags...Beakers...and Barrels
Grades 7-12
Industrial Sales Policy Center
17 Brickel
Columbus, OH 43215
(614) 224-4111
Call for cost information

A five unit curriculum designed to help students better understand the problems associated with hazardous materials. Units progress towards completion of a community action project.

Report Card	7-9	10-12
General Content	A	B
Presentation	B+	B-
Pedagogy	B+	B-
Teacher Usability	A-	B-
Hazardous Waste	A-	B-

The Waste Hierarchy: Where is "Away"
Grades 7-9
SEPUP (Science Education for Public Understanding Program)
Lawrence Hall of Science
University of California, Berkeley
1 Centennial Drive
Berkeley, CA 94720
(510) 642-8718
$225, includes materials for 160 students

SEPUP is a diverse educational program highlighting chemicals and their uses in the context of societal issues. Students will learn to apply the waste management hierarchy to develop an integrated waste management plan that will extend the life of their landfill. 154 pages.

Report Card	7-9
General Content	A-
Presentation	B+
Pedagogy	A-
Teacher Usability	A
Solid Waste	B+

The California CLASS Project
(Classroom Learning Activities in Science and Social Studies)
Grades 6-9
Developed by: National Wildlife Federation and the Orange County, CA Superintendent of Schools
Distributed by: California Dept. of Education
Bureau of Publications, Sales Unit
P.O. Box 271
Sacramento, CA 95812-0271
Item No. 9939
(916) 445-1260
$28 (plus tax for CA residents)

A series of 33 classroom-ready lessons presented in six thematic units: Energy Use, Hazardous Substances, Wildlife Habitat Management, Wetlands, Forest Watershed Management, and Environmental Issues. 373 pages, 1992. Currently under revision.

Report Card	K-3
General Content	A-
Presentation	B
Pedagogy	B+
Teacher Usability	A
Hazardous Waste	B

Waste: A Hidden Resource
Grades 7-12
Developed by: Tennessee Valley Authority
Distributed by: Keep America Beautiful, Inc.
Ordering Dept.
West Broad Street
Stamford, CT 06902
$50 plus %5.50 postage and handling

Designed to supplement existing curriculum, this package is arranged in four chapters: An Overview of Solid Waste, Hazardous Wastes, Municipal Wastes, and A Simulation: Crisis in Center City. 264 pages. To be updated June 1993.

Report Card	7-9	10-12
General Content	B	NR
Presentation	C+	NR
Pedagogy	B-	NR
Teacher Usability	B	NR
Solid Waste	A-	NR
Hazardous Waste	A-	NR

California Compendium for Integrated Waste Management

GREAT
(Groundwater Resources and Educational Activities for Teachers)
Grades 7-9
Developed by: Iowa Dept. of Natural Resources
Distributed by: ERIC Clearinghouse for Science, Mathematics, and Environmental Education
The Ohio State University
1200 Chambers Road, Third Floor
Columbus, OH 43212
(614) 292-6717
Call for availability and price information

A six-unit, science-based curriculum dealing with groundwater protection in Iowa, including the impacts of hazardous wastes and substances on groundwater.

Report Card	7-9
General Content	B+
Presentation	B-
Pedagogy	B-
Teacher Usability	B
Hazardous Waste	B

Household Hazardous Waste
How It Fits into Your Curriculum
Grades 6-12
Call for cost information.

An anthology aimed at middle and high school students, and divided into seven sections: Groundwater, Household Hazardous Waste, At School, At Home, At Work, Health Effects/Alternatives, Ecology, and Stewardship. 378 pages, 1992.

Report Card	7-9	10-12
General Content	B-	NR
Presentation	C+	NR
Pedagogy	B-	NR
Teacher Usability	C+	NR
Hazardous Waste	A-	NR

The Earth Time Project
Environmental Education Program
Grades 7-12
P.O. Box 1111
Ketchm, ID 83340
(208) 726-4030 Dean Paschall
Call for cost information

A student-directed activities guide wherein students, faculty and staff are brought together to address seven environmental concerns inherent in every school: Energy Conservation, Water Conservation, Landscaping and Gardens, Waste Management and Recycling, Chemical Products Use, Food Systems, and Pesticide Management. Published in 1993, however, a new version is set for release in June 1993. Translation into several languages is planned.

Report Card	7-9	10-12
General Content	B+	B
Presentation	B+	B
Pedagogy	A-	C+
Teacher Usability	C+	C+
Solid Waste	C-	B
Hazardous Waste	D+	C-

Investigating Hazardous Materials
Grades 7-9
SEPUP (Science Education for Public Understanding Program)
Lawrence Hall of Science
University of California, Berkeley
1 Centennial Drive
Berkeley, CA 94720
(510) 642-8718
$175, includes materials for 160 students

SEPUP is a diverse educational program highlighting chemicals and their uses in the context of societal issues. In this module a simulation involving a drum containing mixed waste is used to introduce concepts and processes used in hazardous materials identification. 90 pages, 1993.

Report Card	7-9
General Content	B+
Presentation	B
Pedagogy	B+
Teacher Usability	A
Hazardous Waste	D+

Recycle Hawaii for Kids
Grades 9-12
City and County of Honolulu
Recycling Office
Division of Refuse Collection and Disposal
650 South King Street, 6th floor
Honolulu, HI 96813
(808) 527-5335 Suzanne L. Varady
Curriculum free, must pay postage.

A collection of lessons generated by teachers and taken from existing curricula. Divided into five units: What's in the Can, Man?, How Can We Stop Throwing Away So Much "Trash!", Once in Not Enough, Composting, and Landfills and Incinerators. 166 pages, 1990.

Report Card	10-12
General Content	B-
Presentation	C
Pedagogy	C+
Teacher Usability	B+
Solid Waste	B

Glossary

acid rain - precipitation which is made acidic by chemical reaction with pollutants in the atmosphere

aerobic - decomposition that takes place in the presence of oxygen

anaerobic - decomposition that takes place in the absence of oxygen, usually producing methane and foul odors

ash - the solid residue left when combustible material is burned

ashfill - a special secure landfill used for the disposal of incinerator ash

bauxite - the raw material from which aluminum is extracted; aluminum ore mined from the earth

biodegradable - the term describing a substance which can be broken down into simpler compounds by decomposing organisms

bottle bill - legislation in effect in Maine and other states which requires a deposit on beverage containers, the deposit is returned to the consumer when the container is redeemed at a collection site; incentive to return containers for recycling

bottom ash - ash that drops out at the bottom of an incinerator and is disposed (usually in a secure landfill)

close the loop - completing the recycling process by buying products made from recycled materials

composite liner - a landfill liner made of both plastic and soil components

compost - the product of composting; a mixture that consists largely of decayed organic matter which is a useful soil additive

composting - a waste management strategy where organic wastes are partially decomposed by aerobic bacteria and fungi, producing a useful soil additive; fourth priority in the waste management hierarchy

consumer goods - products sold to the end-user; the products usually sold in stores

consumption - the use of resources (either materials or energy)

convenience foods - single-serving or highly processed foods designed to be easy-to-use; often create a large amount of packaging waste per serving

corrosive - the quality of certain substances which are either extremely acidic (pH below 2) or basic (pH above 12.5) capable of dissolving or breaking down other substances, particularly metals, or causing burns on skin

cullet - crushed glass, a step in the process of recycling glass

curbside pickup - a service to residents and businesses where a trash hauler collects waste and/or materials separated for recycling and left at the curb

decomposition - the natural process of recycling of organic matter by breaking down into its constituent parts

design for disassembly, design for recycling - a concept in product design where plans are made for ease of disassembly or recycling at the end of the product's life

disposable product - a product designed for single-use or short life span, e.g. disposable diapers, ball point pens

durable product - a product that is designed to have an extended life span; opposite of disposable

elbow grease - technique used in cleaning typified by physical effort, e.g. scrubbing, rather than using chemical products

environmental cost - a calculation of the effect that the production of a product has on the environment, usually considers the effect of resource depletion and pollution in extraction, manufacture, transportation, use and disposal

EPA (U.S. Environmental Protection Agency) - the federal agency charged with enforcement of all federal regulations having to do with air and water pollution, radiation and pesticide hazard, ecological research, and solid waste disposal

fly ash - airborne particles produced during incineration; usually filtered before the smoke is released

green products (green consumer choices) - items which have a lower environmental cost than traditional products

groundwater - water stored in the porous spaces of soil and rock underground; source of water in many drinking water wells

hazardous material - chemical or product that poses a significant threat to human health and/or the environment in use, transportation, or disposal

hazardous waste - waste that is dangerous to human health and/or the environment; defined as waste that is toxic, reactive, ignitable, corrosive, or radioactive

heavy metals - elements used in the manufacture of certain products which are toxic such as lead, mercury, and arsenic, among others

Glossary

high-speed digestion - an experimental waste management process in which the natural composting process is accelerated

humus - partially decayed organic material produced in a compost heap; contains humic acids

hydrapulper - a large blender used to shred paper as it is processed into pulp and ultimately remanufactured into recycled paper

incineration - burning; waste disposal technique, fifth priority in the waste management hierarchy

incinerator - facility designed for the controlled burning of waste; reduces waste volume by converting waste into gases and relatively small amounts of ash

inventory - a complete list of items and the quantity present in a particular place at a certain time

junk mail - unwanted advertisements or other material sent through direct mailings to consumers or businesses; can be controlled by restricting distribution of recipient's name and address

landfill - a large outdoor area for waste disposal; in sanitary landfills waste is layered with soil and compacted; lined landfills have a barrier to prevent leaking into the surrounding area (secure landfill)

leachate - the liquid formed when water passes through a landfill picking up a variety of suspended and dissolved materials from the waste; can be toxic and may be carried into the ground water if not contained

lightweighting - package design which requires less material in the packaging, e.g. thinner plastic bottle where strength is maintained by rounding the corners

lower-use - term used to describe products made from recycled materials which do not have as high quality as products made from new materials; paperboard is a lower use of fiber than office paper

macroorganisms - visible animals such as earthworms, sow bugs, mites, millipedes, and beetles that live in compost at the cool, end stage

mass burn incinerator - a type of incinerator in which waste is not separated before going into the burn chamber; white goods and obviously hazardous materials such as car batteries are usually removed, but little else is

mesophylic - compost bacteria which thrive in the middle range, warm-temperature stage of composting

methane- a colorless flammable gas; byproduct of anaerobic decomposition common in landfills which must be vented or burned to prevent gas buildup and potential explosion; can be used as fuel

Model Business/Community Program - an incentive program of the Maine Waste Management Agency which encourages businesses and civic groups to reduce waste generation and to recycle

monofill - a special secure landfill which is used only for a single type of waste, e.g. ashfill

MSDS (Material Safety Data Sheets) - information provided by manufacturers of hazardous substances which specify contents, and procedures for handling, storage, and disposal; also available from Flinn Scientific (see address in Resources)

MSW (municipal solid waste) - solid waste produced by residential, commercial, and institutional generators within a community, does not include industrial or agricultural waste

MWMA (Maine Waste Management Agency) - the state agency in Maine formed by the legislature to administer the state's waste management and recycling programs; the agency includes the Office of Planning, Siting and Disposal Operations, and the Office of Waste Reduction and Recycling; see listings in Resources

natural resources - materials derived from the earth which are used for energy or in the manufacture of goods

ni-cad (nickel-cadmium) - a type of rechargeable battery; can be recycled

open dump - traditional waste disposal method of open piles of garbage; now prohibited in Maine

overpackaged - term describing goods which have more packaging material than is necessary to simply wrap, contain, or protect the product; overpackaging is a source of waste that can be reduced

packaging - the materials used to wrap, contain, and protect products; may also advertise the product

paperboard - a type of thin cardboard used for products like cereal boxes; often made of recycled fiber

particulates - minute particles of ash carried in the hot gasses produced in incinerators; usually "scrubbed" before the gasses are released

plastic resin (polymer) - specific organic compounds which determine the characteristics of plastic; different plastic resins must be separated and recycled separately

post-consumer content - in a recycled product, the amount of material that has been previously used at the consumer level and returned for recycling and remanufacture

pre-consumer content - in a recycled product, the amount of material that has been recovered from the manufacturing process and recycled into a new product; recycled material that has not been used at the consumer level

psychrophilic - the first stage of composting in which simple bacteria thrive in cool temperatures producing carbon dioxide and heat

pulp - digested wood fibers that are then made into paper; new pulp is derived from wood, recycled pulp is derived directly from paper and is then remanufactured into recycled paper

raw materials - substances still in their natural state before processing or manufacturing; the starting materials for a manufacturing process; sometimes referred to as "virgin materials"

RDF (refuse-derived fuel) incinerators - facilities where non-combustible materials are separated and removed before going into the burn chamber; the recovered materials are reused or recycled

reactive - a category of hazardous material which tends to react spontaneously with air or water, explode when dropped, or release toxic gasses

recovered materials - those materials which are separated and collected for recycling, removed from the waste stream for sale, use, or reuse

recycle - a waste management strategy where materials from waste are recovered, reprocessed, and manufactured into new products; third priority in the waste management hierarchy

recycled - composed of materials which have been processed and used again

reduce - see source reduction; the first priority in the waste management hierarchy

refillable - term used to describe containers which can be used several times to hold the same product

returnable - can be returned for deposit and/or reuse

reuse - a waste management strategy which advocates finding alternative uses for items which are no longer needed for their original purpose; second priority in the waste management hierarchy

scrubbers - the mechanical and chemical cleaners of incinerator gasses; wet-dry scrubbers use limewater, baghouse filters settle particles out, electrostatic precipitators remove particles with an electric charge

slurry - mixture of water and paper fiber that comes from a hydrapulper as paper is recycled

small quantity generator - an individual, business, or organization that produces a measurable amount of hazardous waste but less than 1000 kilograms/month; regulated in Maine by the Dept. of Environmental Protection Bureau of Hazardous Materials & Solid Waste Control

solid waste - any of a variety of solid materials and liquids that are considered unusable and must be discarded; includes household garbage, food waste, yard trash, white goods, ash, sludge, or other discarded material

source reduction - a waste management strategy which attempts to decrease the amount and toxicity of solid waste before a material enters the waste stream; reducing the amount of waste by design and engineering; first priority in the waste management hierarchy

sustainable future - the objective of many conservation efforts to minimize the use of resources in the maintenance of a productive lifestyle; an ideal vision of the future where there is no net loss of resources

thermophilic - high-temperature (105° - 158°F) compost bacteria, fungi, and molds that finish the compost process -

tipping fee - the fee charged a waste hauler to deposit material at a transfer station, incinerator, or landfill

toxic - poisonous or harmful to humans and/or the environment

toxicity - a relative measure of how poisonous a substance is; an objective of source reduction waste is to reduce the toxicity of waste as well as the amount of waste

transfer station - a facility designed to store or hold solid waste for transport to a processing or disposal facility

trash - term used for the category of wastes that usually do not include food waste, but may include other organic materials such as yard trimmings

unrecoverable waste - waste which has no reusable or recyclable components and must be disposed of in landfill or incinerator

user fees - money charged to recipients of a particular service, e.g. fees charged by a trash hauler to collect trash curbside

vitrification - an experimental waste management process is which waste is exposed to extremely high temperatures and transformed into dense inert chunks of material

Glossary

waste - any material that is not used and is discarded

waste audit - inventory of waste produced in a particular place over a certain period of time; the analysis from a waste audit can help identify targets for waste reduction and recycling efforts

waste exchange - a system which allows the waste from one activity to be used as a resource in another activity

waste management hierarchy - the priority order of managing waste developed by the EPA and adopted by others; the hierarchy adopted by the MWMA is 1) Reduce, 2) Reuse, 3) Recycle, 4) Compost, 5) Incinerate, 6) Landfill

waste stream - the total waste produced by a community or society, as it moves from origin to disposal; all of the waste generated in the process of production, utilization, and disposal of goods

waste-to-energy - the type of incinerator which generates electricity from the heat produced from burning waste

WasteCap - a business assistance program of the Maine Waste Management Agency in which a team of volunteers evaluates businesses and industrial facilities and recommends waste reduction strategies

white goods - major household appliances such as refrigerators, washers, ranges that are typically but not always finished in white enamel